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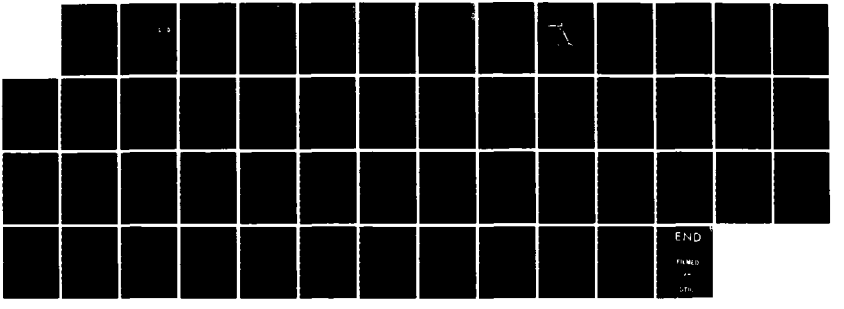

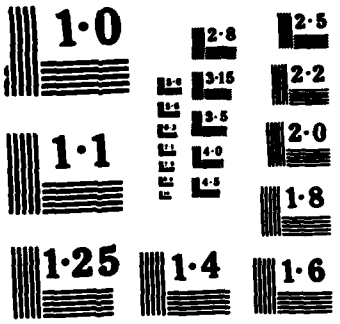

NPS 68-86-001

NAVAL POSTGRADUATE SCHOOL

Monterey, California

HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM
OPTOMA18
31 October and 2 November 1985

by

Paul A. Wittmann
Marie C. Colton
John J. Rendine
Christopher N.K. Mooers

December 1985

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NAVAL POSTGRADUATE SCHOOL

Monterey, California 93943

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Two P3 flights comprising OPTOMA18 were undertaken on 31 October and 2 November 1985 to sample a subdomain of the California Current System. This report presents the hydrographic data, acquired by AXBT deployments, from the flights.

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Hydrographic Data from the **OPTOMA** *Program:*

OPTOMA18

31 October and 2 November, 1985

by

Paul A. Wittmann
Marie C. Colton
John J. Rendine
Christopher N. K. Mooers

The **OPTOMA** Program is a joint program of

Department of Oceanography
Naval Postgraduate School
Monterey, CA 93943.

Center for Earth and Planetary Physics
Harvard University
Cambridge, MA 02138.

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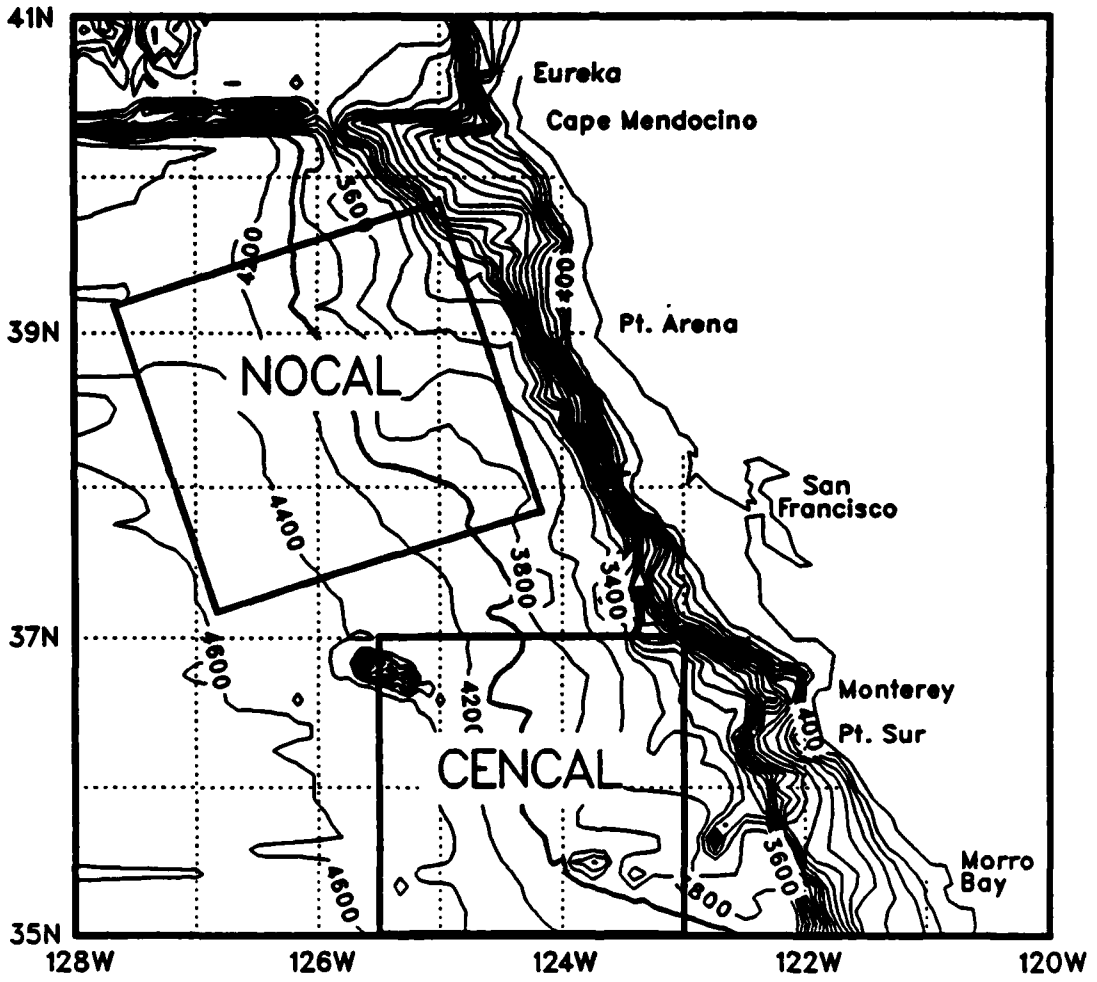


Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observation, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises and P3 flights has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

OPTOMA 18 Flight I was conducted by Patron Forty-six, COMPATWING TEN on 31 October 1985 in the CENCAL domain and Flight II was conducted by Patron Ninety-one, COMRESPATWINGSPAC on 2 November 1985 in the NOCAL domain. Bathythermographic data were acquired along the tracks shown in figures 2 and 8. The total areal coverage was roughly 530 km alongshore by 260 km cross-shore. Nominal station spacing was about 30 km along-track.

DATA ACQUISITION

Shallow (300m) and deep (700m) AXBT's were deployed from a Navy P3 aircraft during both flights. The aircraft maintained an altitude between 500 and 800 ft, depending on the low level visibility, and an airspeed of 200 knots. Close station spacing (30km) was achieved by alternately dropping Channel 14 and 16 AXBTs. The data were recorded onboard on audio tapes using a stereo tape recorder. Analog traces were also produced using two lofargram recorders which operated on UHF channels 14 and 16. The shallow AXBTs were digitized on-board the aircraft using a Sippican MK9 digitizer. The deep AXBTs were digitized after the flights, at NPS. A complete description of the data acquisition is given in Colton and Mooers (1985).

Station positions were obtained from the aircraft's Inertial Navigation System with hourly updates by TACAN (Tactical Air Navigation); accuracy of

position is within 2.0 km. The thermistor of the Sippican AXBT has an accuracy of ±0.18C in temperature and ±2% or 5m (whichever is greater) in depth.

DATA PROCESSING

Temperatures were computed from the received frequencies according to Sippican (1983). Depths were computed empirically from the descent rate of the AXBT (Bane and Sessions, 1984). The temperature/depth profiles were then edited for erroneous data points, mainly due to RF noise. From the Flight I data set, approximately 86% of casts were retained; of these, 39 were from deep and 39 from shallow AXBT's. From the Flight II data set, approximately 87% of of casts were retained; of these, 40 were from deep and 39 from shallow AXBT's. The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, D.C.

DATA PRESENTATION

The flight track, station locations and station numbers are shown in the first three figures of Sections I and II. These figures are followed by a listing of the stations, with their coordinates, and the date and time at which each station was occupied.

Vertical temperature profiles from the AXBT casts are shown in staggered fashion. The location of these profiles may be found by reference to the various maps of the flight track. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; an appropriate multiple of 5C has been added to each subsequent profile.

Isotherms along each transect are shown in the next pages. Transect extremes are identified. Based on instrument accuracy and the vertical temperature gradient, it is estimated that depths of isotherms in the main thermocline are uncertain to ±20m.

The data presentation concludes with plots of mean temperature profiles, with + and - the standard deviations.

SECTION I

OPTOMA 18 FLIGHT I

OCTOBER 31, 1985

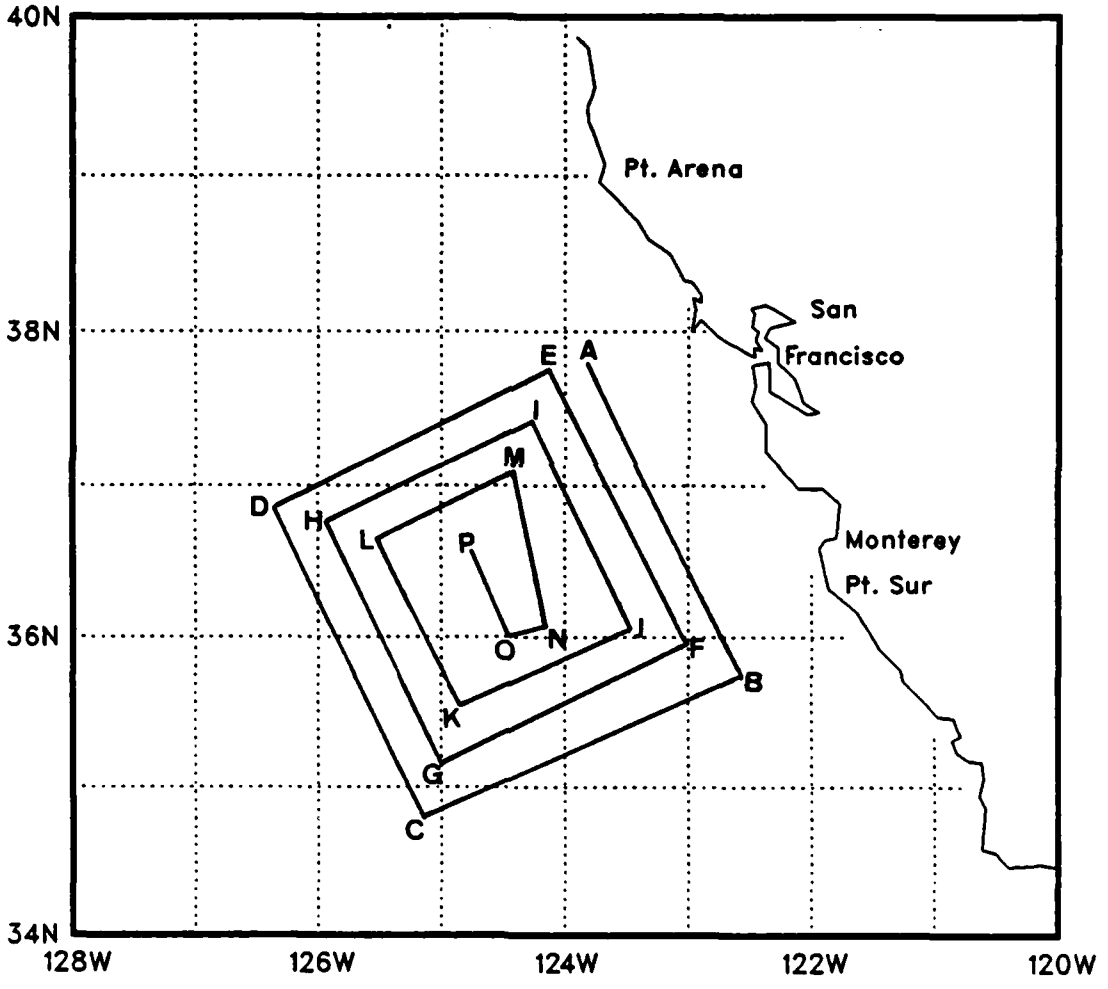


Figure 2. The flight track for OPTOMA18 Flight I.

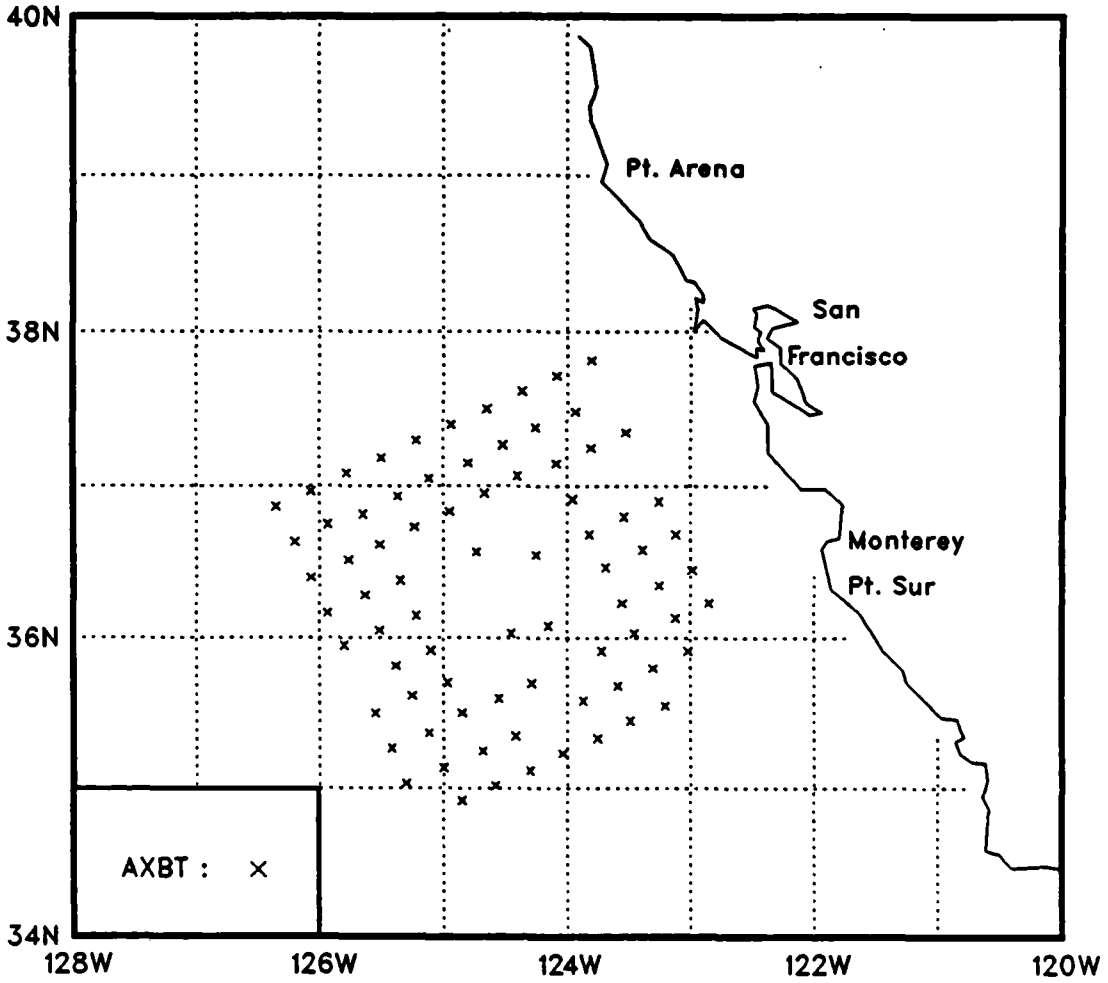


Figure 3. AXBT station locations for OPTOMA18 Flight I.

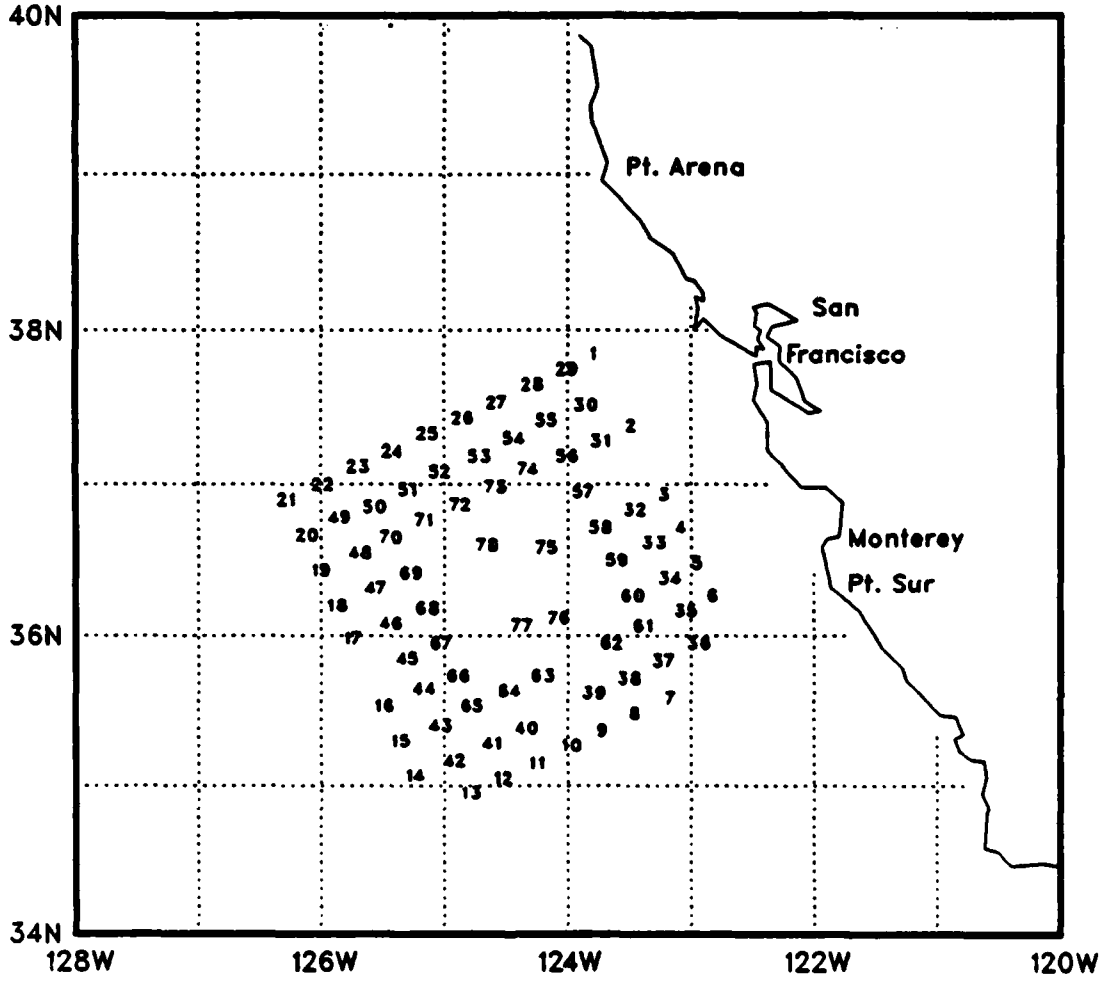


Figure 4. Station numbers for OPTOMA18 Flight I.

Table 1: Flight I Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
1	AXBT	85304	1622	37.49	123.48	12.3
2	AXBT	85304	1631	37.21	123.31	11.6
3	AXBT	85304	1638	36.54	123.15	12.9
4	AXBT	85304	1639	36.41	123.07	13.7
5	AXBT	85304	1620	36.27	122.59	13.7
6	AXBT	85304	1649	36.14	122.51	14.3
7	AXBT	85304	1704	35.33	123.12	14.8
8	AXBT	85304	1712	35.27	123.29	14.5
9	AXBT	85304	1717	35.20	123.45	14.6
10	AXBT	85304	1721	35.14	124.02	15.0
11	AXBT	85304	1725	35.07	124.18	15.8
12	AXBT	85304	1730	35.01	124.35	16.0
13	AXBT	85304	1734	34.55	124.51	16.0
14	AXBT	85304	1742	35.02	125.18	14.9
15	AXBT	85304	1743	35.16	125.25	15.4
16	AXBT	85304	1751	35.30	125.33	15.6
17	AXBT	85304	1800	35.57	125.48	16.2
18	AXBT	85304	1801	36.10	125.56	16.0
19	AXBT	85304	1809	36.24	126.04	16.5
20	AXBT	85304	1810	36.38	126.12	16.0
21	AXBT	85304	1818	36.52	126.21	15.4
22	AXBT	85304	1821	36.58	126.04	15.1
23	AXBT	85304	1827	37.05	125.47	14.8
24	AXBT	85304	1836	37.11	125.30	14.3
25	AXBT	85304	1843	37.18	125.13	13.9
26	AXBT	85304	1844	37.24	124.56	13.9
27	AXBT	85304	1852	37.30	124.39	13.6
28	AXBT	85304	1856	37.37	124.22	13.8
29	AXBT	85304	1900	37.43	124.05	11.6
30	AXBT	85304	1902	37.29	123.56	11.8
31	AXBT	85304	1909	37.15	123.48	12.5
32	AXBT	85304	1917	36.48	123.32	13.2
33	AXBT	85304	1918	36.35	123.23	14.7
34	AXBT	85304	1925	36.21	123.15	15.1
35	AXBT	85304	1928	36.08	123.07	14.9
36	AXBT	85304	1932	35.55	123.01	14.6
37	AXBT	85304	1934	35.48	123.18	15.5
38	AXBT	85304	1942	35.41	123.35	15.7
39	AXBT	85304	1943	35.35	123.52	15.2
40	AXBT	85304	1951	35.21	124.25	14.6
41	AXBT	85304	1953	35.15	124.41	15.3
42	AXBT	85304	2001	35.08	125.00	15.7
43	AXBT	85304	2010	35.22	125.07	15.3
44	AXBT	85304	2011	35.37	125.15	15.2
45	AXBT	85304	2019	35.49	125.23	15.5

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
46	AXBT	85304	2023	36.03	125.31	16.1
47	AXBT	85304	2028	36.17	125.38	16.1
48	AXBT	85304	2029	36.31	125.46	16.3
49	AXBT	85304	2037	36.45	125.56	15.8
50	AXBT	85304	2038	36.49	125.39	15.8
51	AXBT	85304	2046	36.56	125.22	14.4
52	AXBT	85304	2047	37.03	125.07	13.5
53	AXBT	85304	2055	37.09	124.48	13.1
54	AXBT	85304	2057	37.16	124.31	12.8
55	AXBT	85304	2104	37.23	124.15	11.4
56	AXBT	85304	2105	37.09	124.05	13.7
57	AXBT	85304	2113	36.55	123.57	14.0
58	AXBT	85304	2117	36.41	123.49	14.9
59	AXBT	85304	2121	36.28	123.41	15.3
60	AXBT	85304	2125	36.14	123.33	15.7
61	AXBT	85304	2129	36.02	123.27	15.8
62	AXBT	85304	2130	35.55	123.43	16.0
63	AXBT	85304	2141	35.42	124.17	15.5
64	AXBT	85304	2147	35.36	124.33	15.3
65	AXBT	85304	2149	35.30	124.51	14.8
66	AXBT	85304	2156	35.42	124.58	15.7
67	AXBT	85304	2157	35.55	125.06	15.7
68	AXBT	85304	2205	36.09	125.13	16.4
69	AXBT	85304	2206	36.23	125.21	15.8
70	AXBT	85304	2215	36.37	125.31	16.7
71	AXBT	85304	2216	36.44	125.14	14.8
72	AXBT	85304	2225	36.50	124.57	13.3
73	AXBT	85304	2228	36.57	124.40	14.1
74	AXBT	85304	2233	37.04	124.24	14.9
75	AXBT	85304	2235	36.33	124.15	15.8
76	AXBT	85304	2250	36.05	124.09	15.4
77	AXBT	85304	2252	36.02	124.27	15.9
78	AXBT	85304	2310	36.34	124.44	15.8

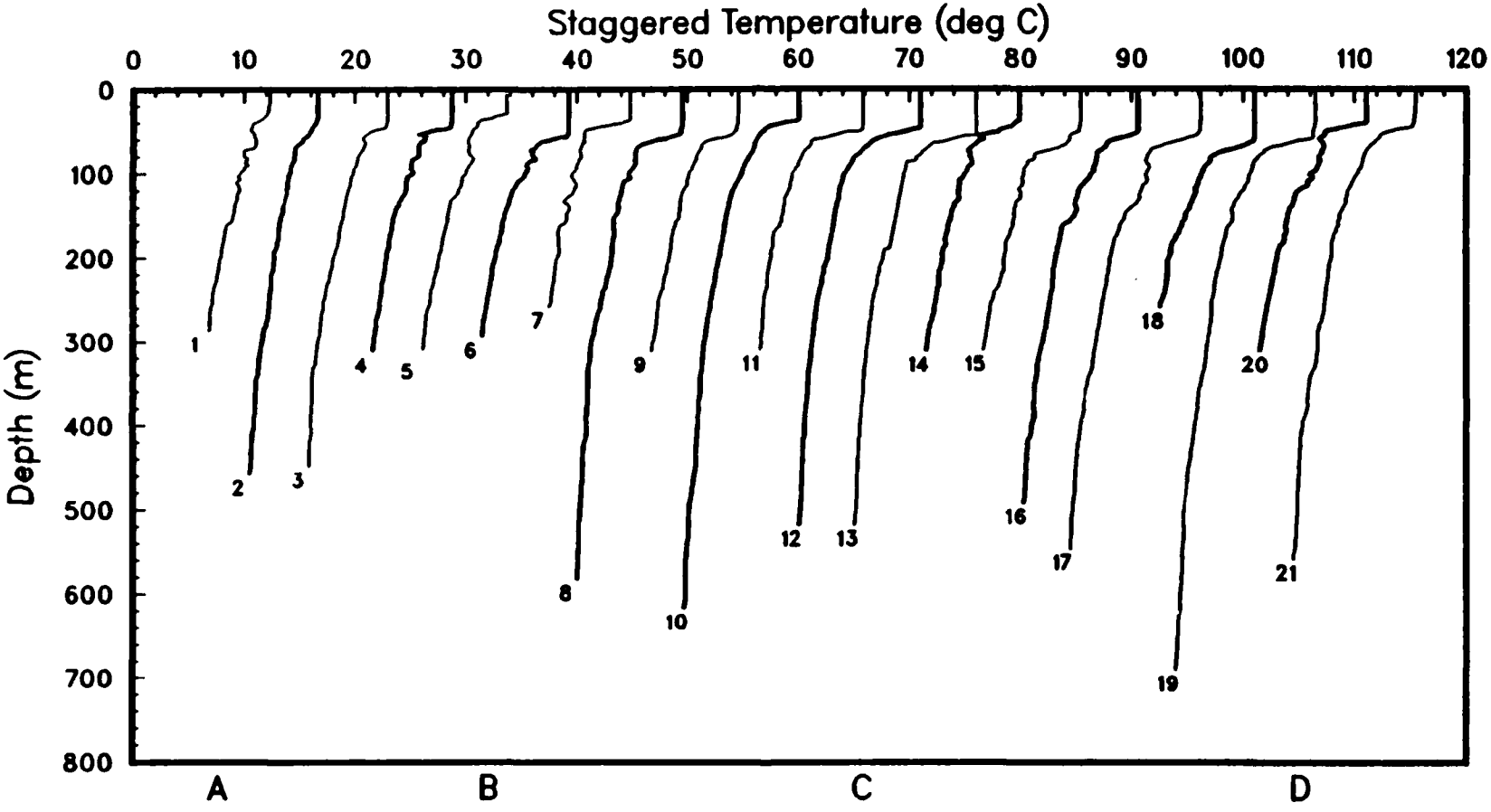
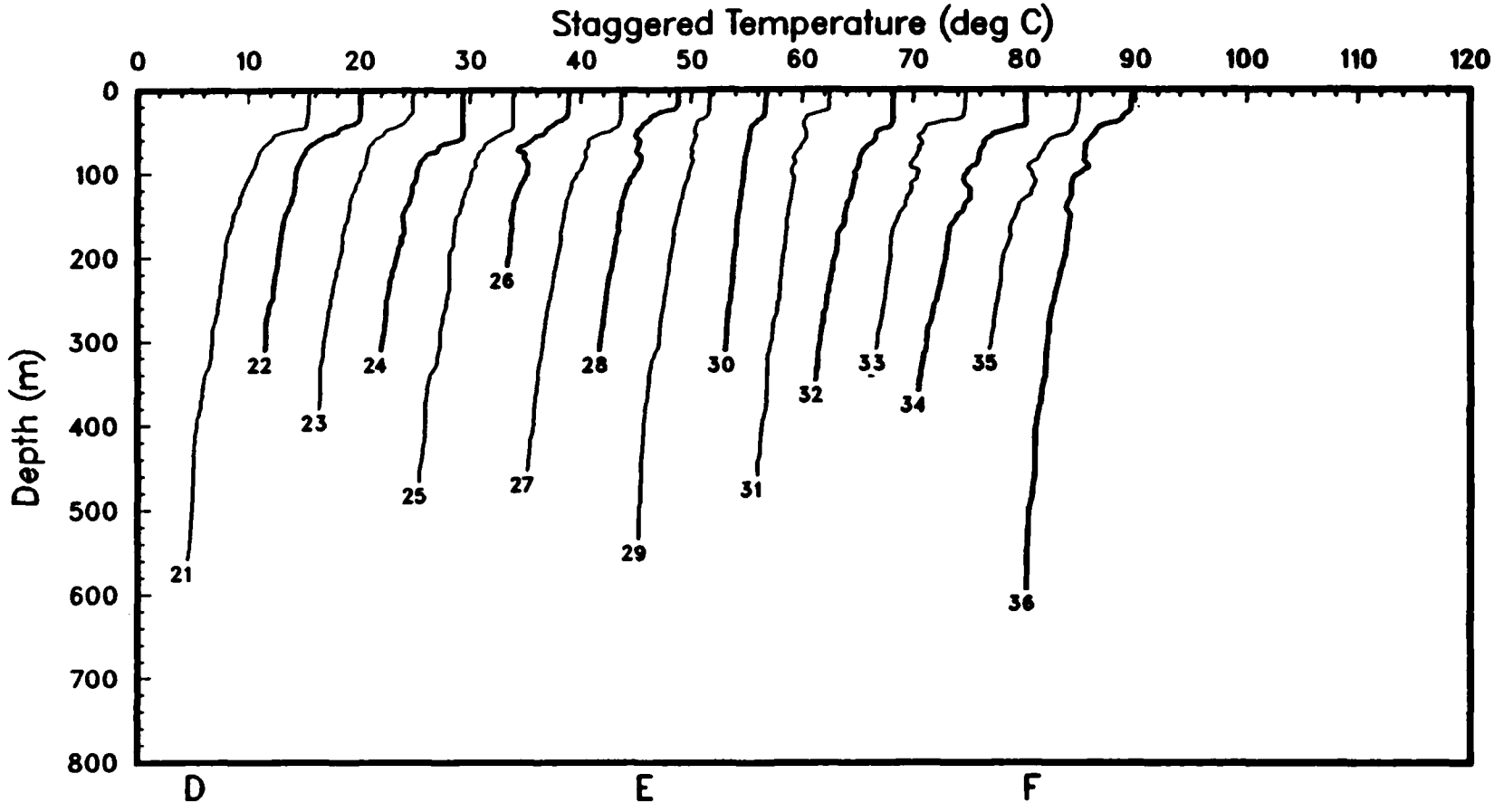


Figure 5 (a). Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight I).


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
21
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32
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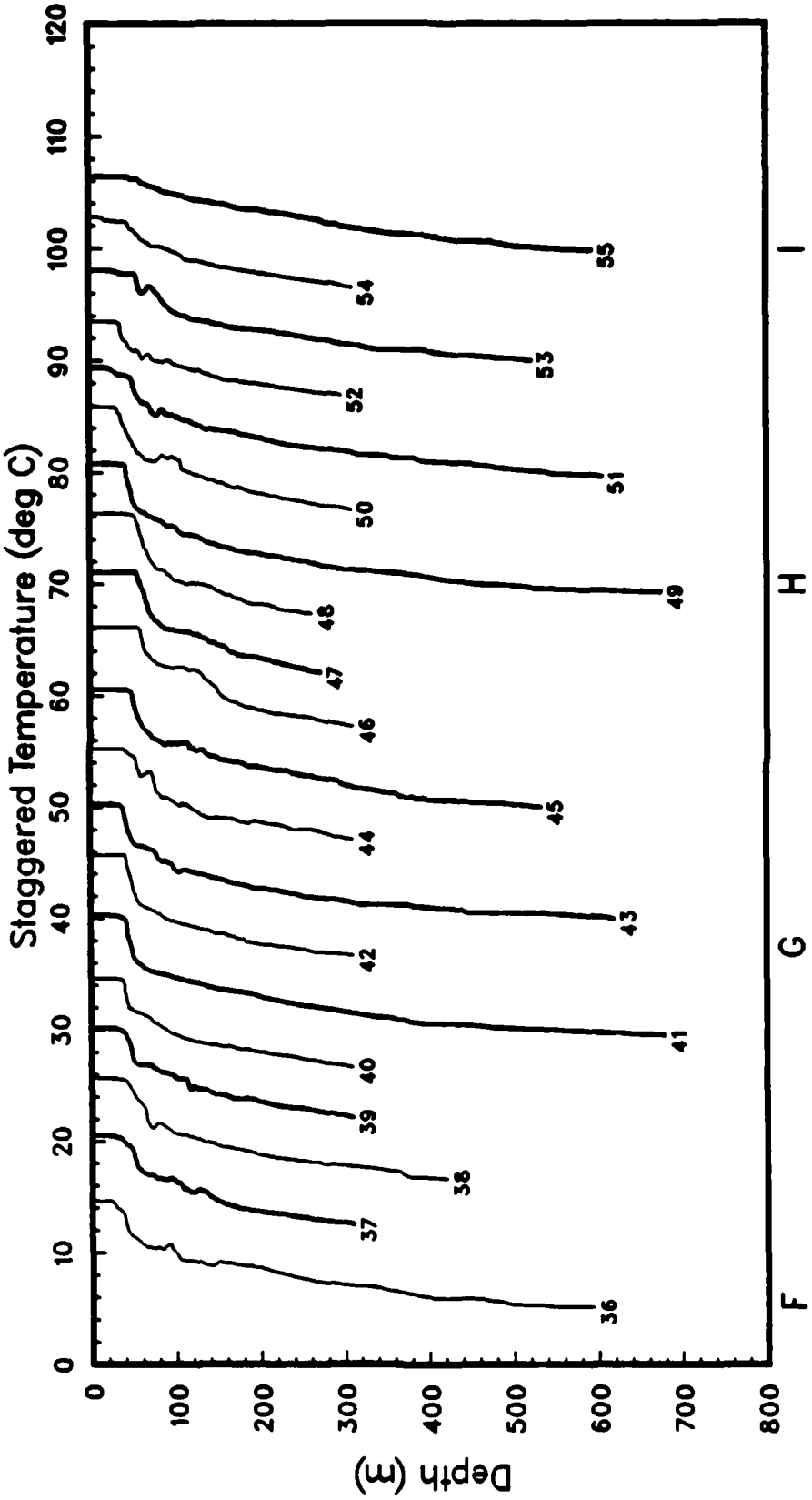
35
36
D
E
F

Figure 5 (b).


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
700
800
36
37
38
39
40
41
42
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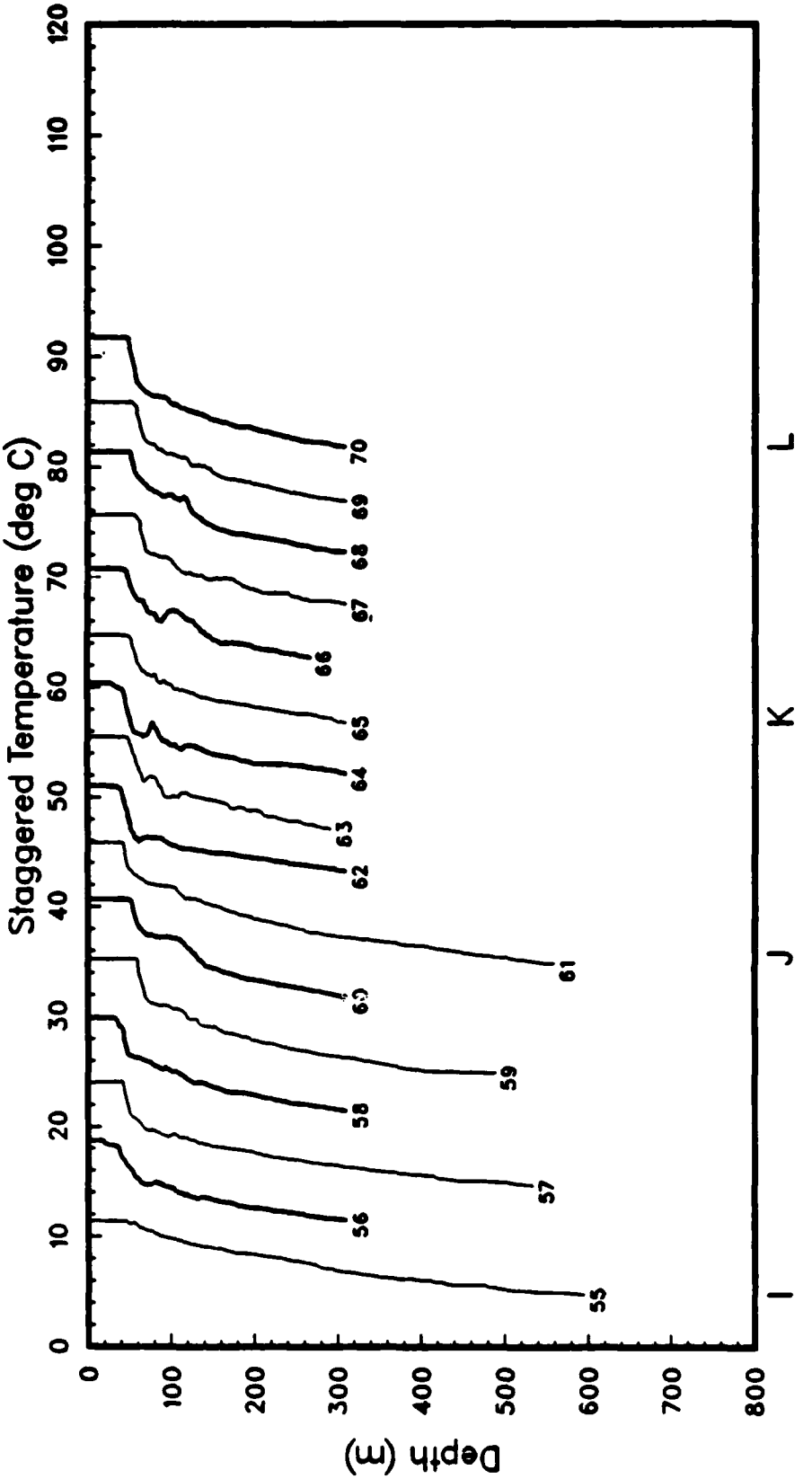
51
52
53
54
55
F
G
H
I

Figure 5 (c).


Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
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100
200
300
400
500
600
700
800
55
56
57
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59
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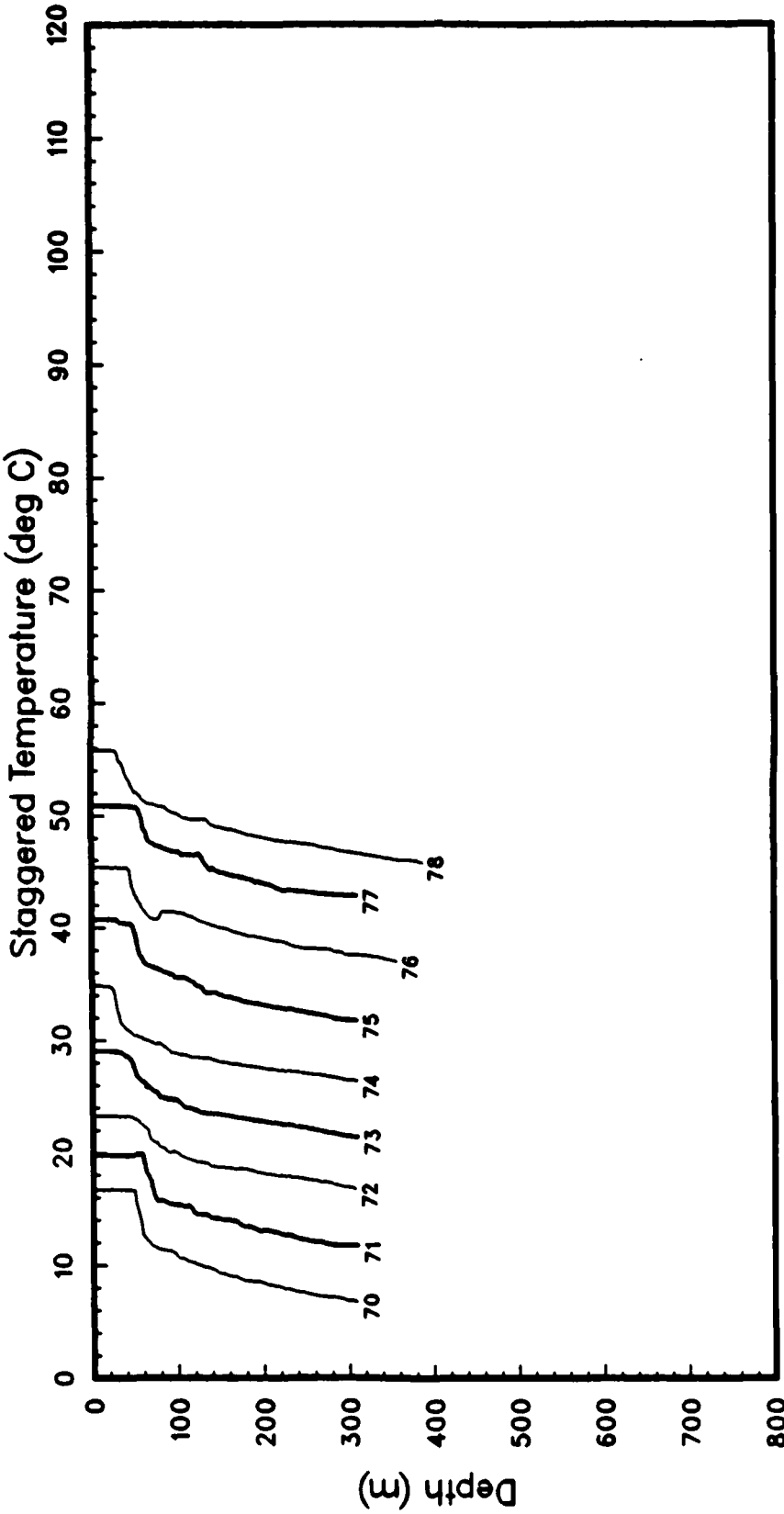
61
62
63
64
65
66
67
68
69
70
I
J
K
L

Figure 5 (d).


Staggered Temperature (deg C)
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10
20
30
40
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60
70
80
90
100
110
120
Depth (m)
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100
200
300
400
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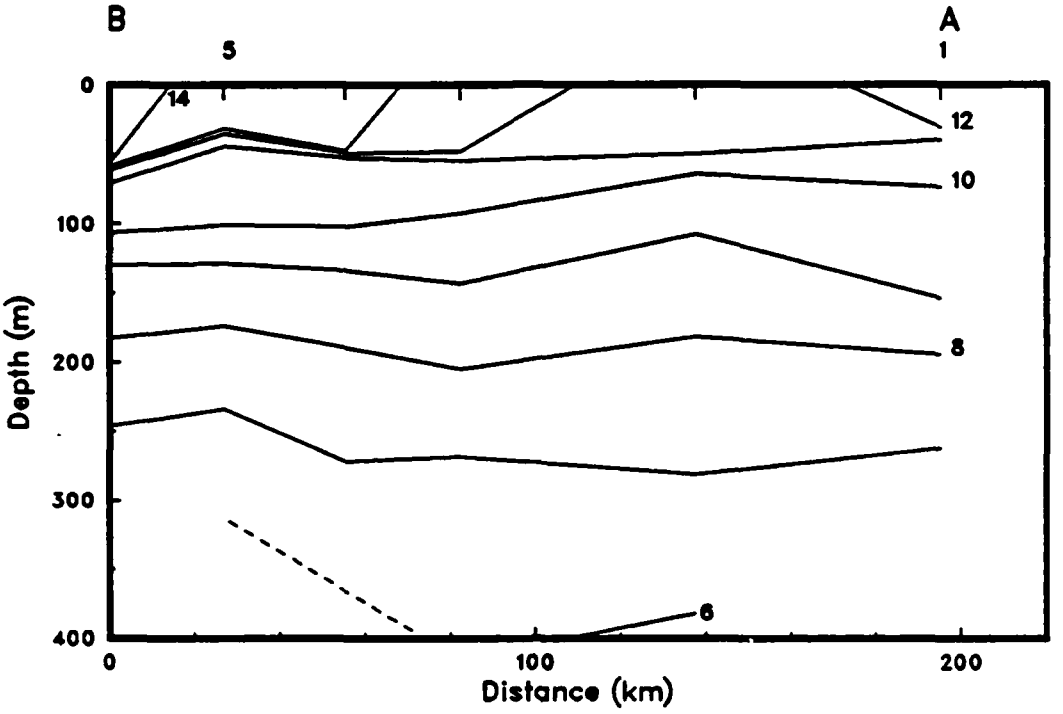
Figure 5 (e).



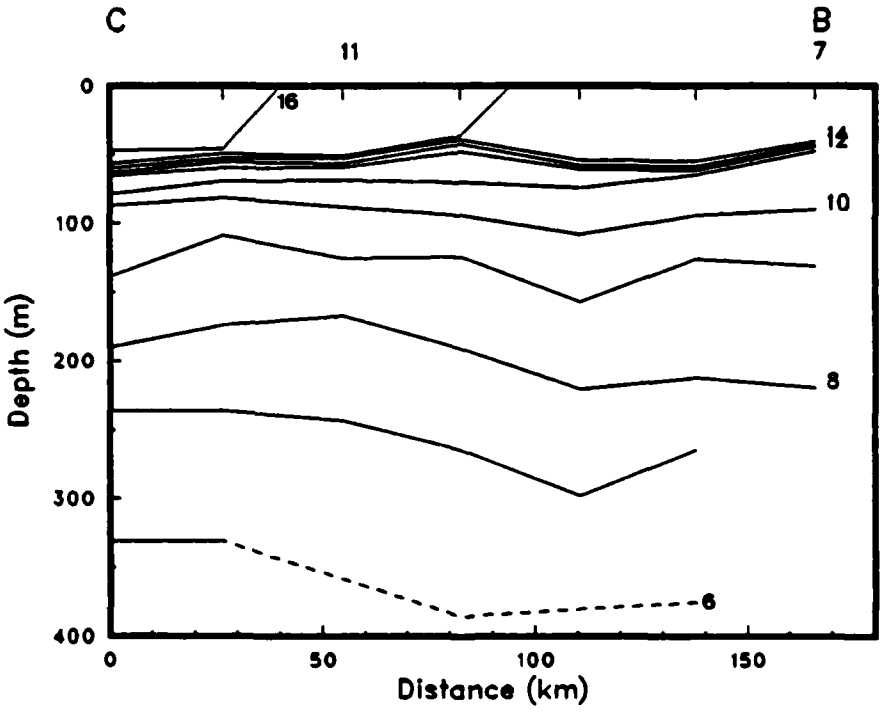
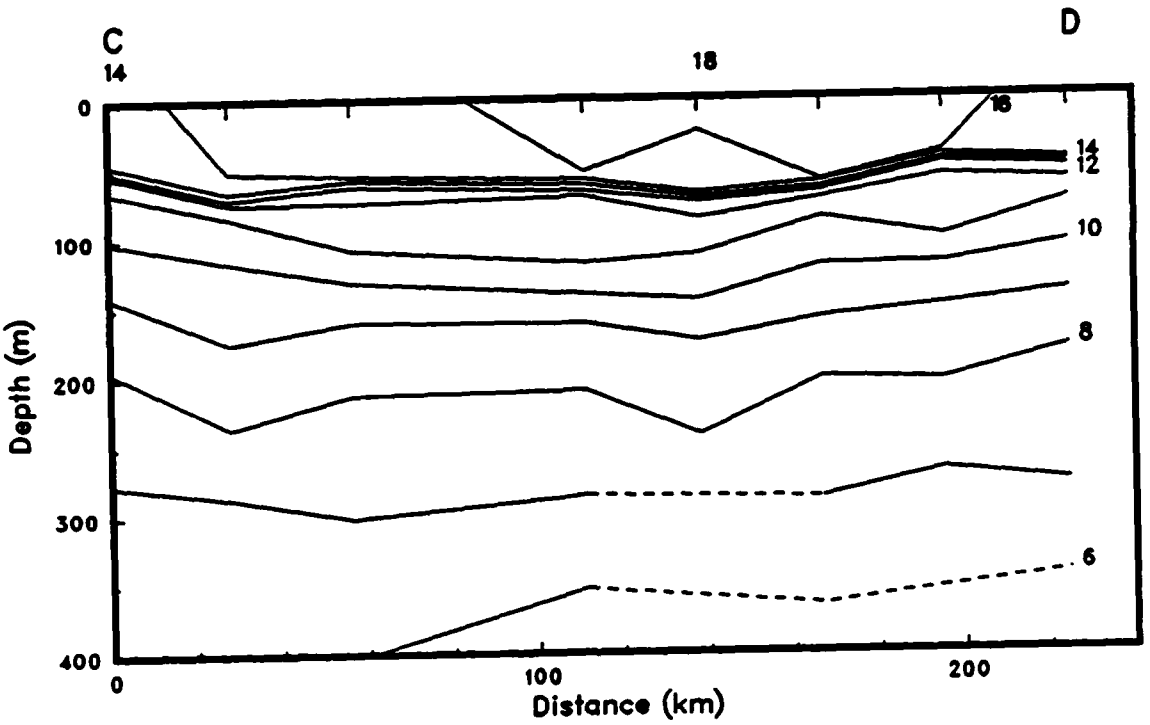


Figure 6 (a). Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow (OPTOMA18 Flight I).


C
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D
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14
12
10
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6
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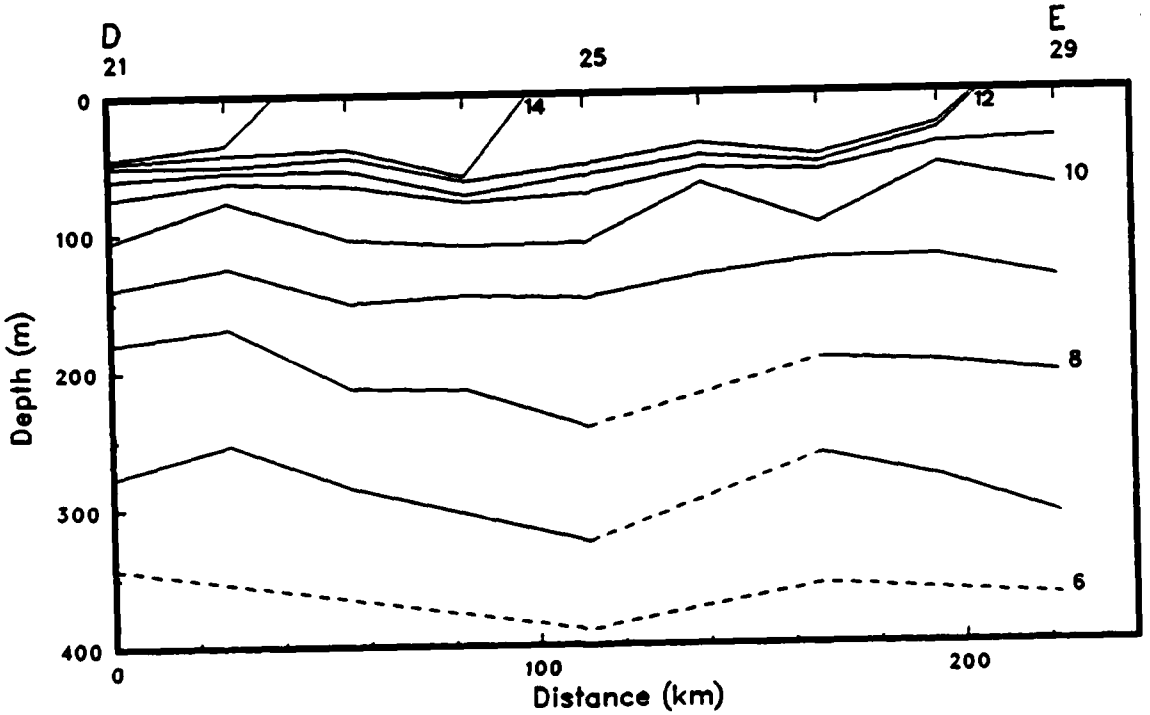
200
300
400
Depth (m)
0
100
200
Distance (km)


D
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E
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14
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Depth (m)
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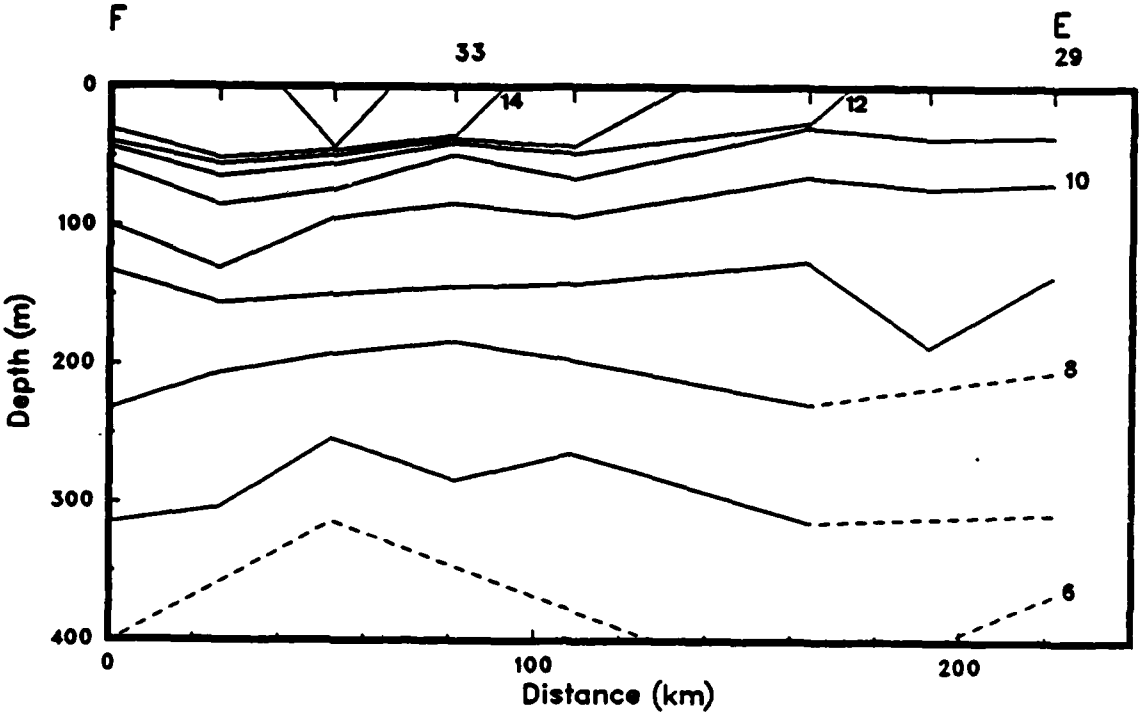
100
200
Distance (km)

Figure 6 (b).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Depth (m)
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8
6
0
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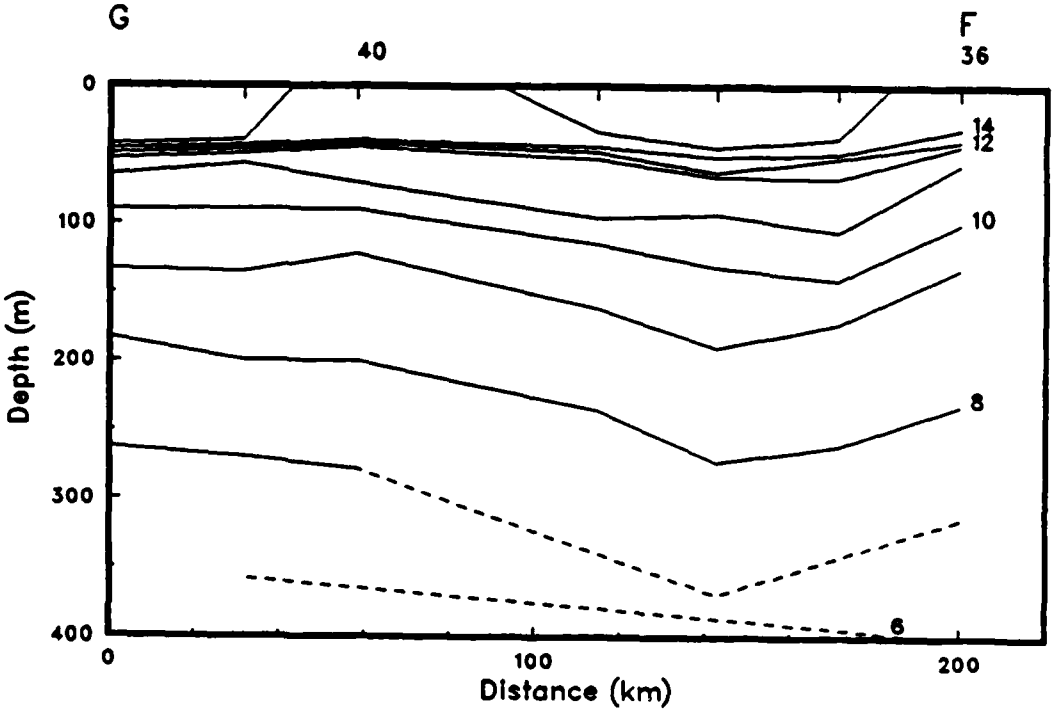
200
Distance (km)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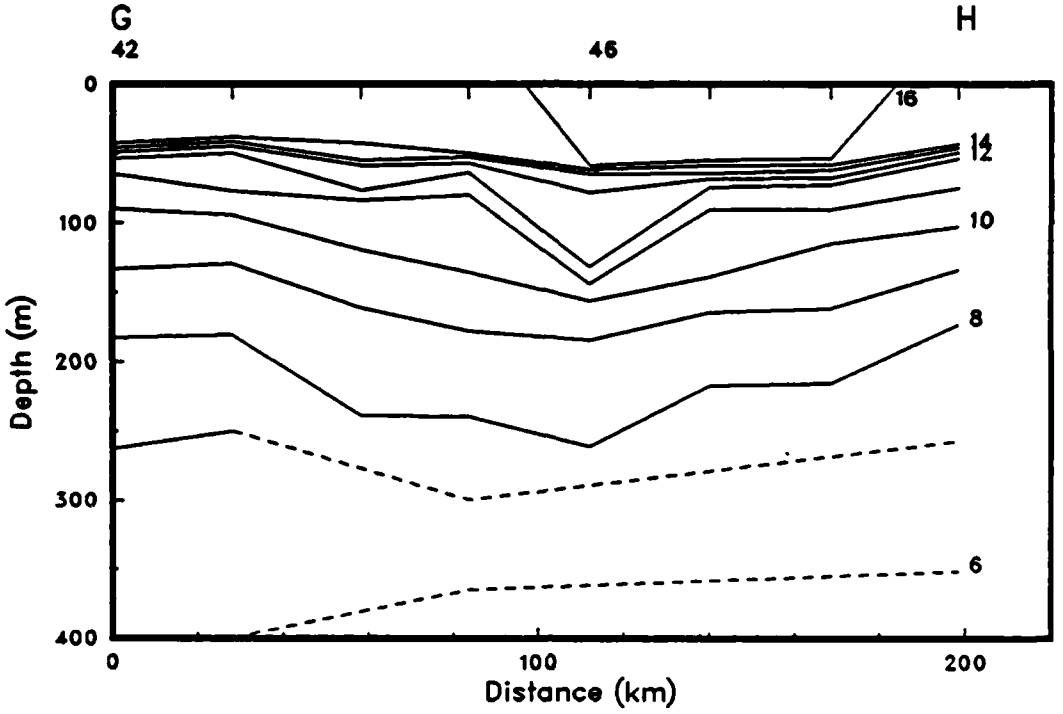
Distance (km)

Figure 6 (c).


G
H
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Depth (m)
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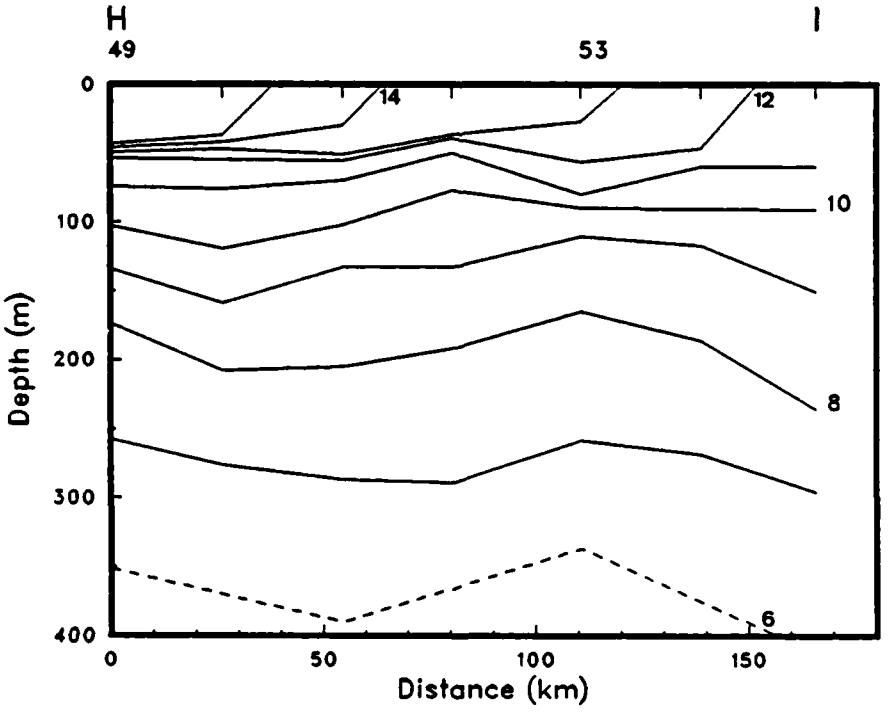
Distance (km)


H
I
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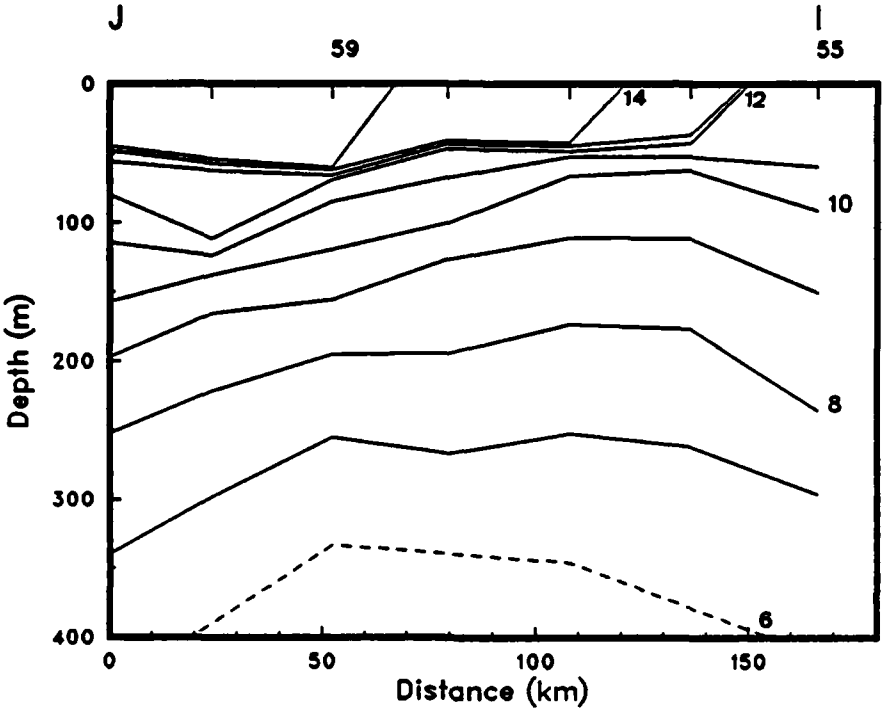
Distance (km)

Figure 6 (d).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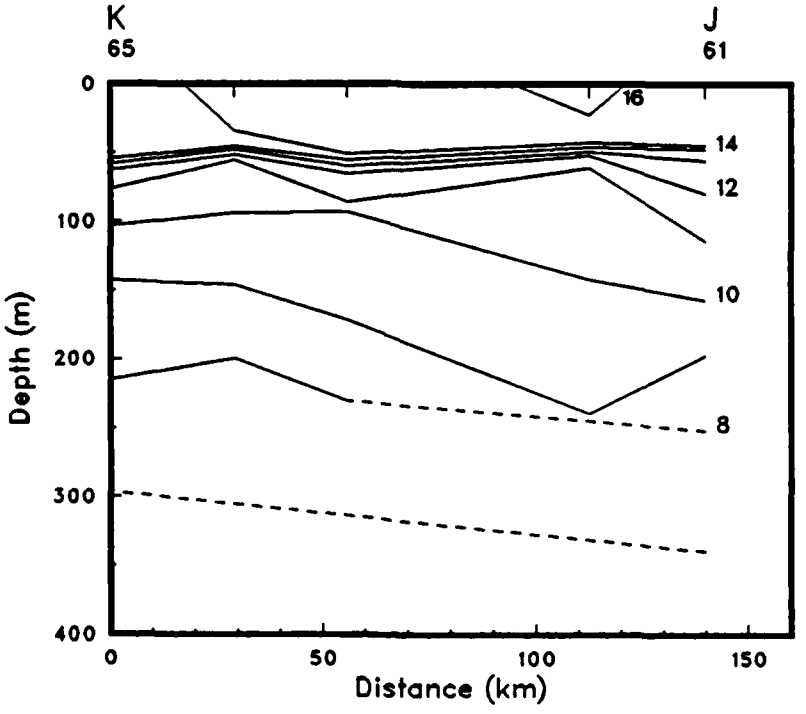
Distance (km)


K
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J
61
0
100
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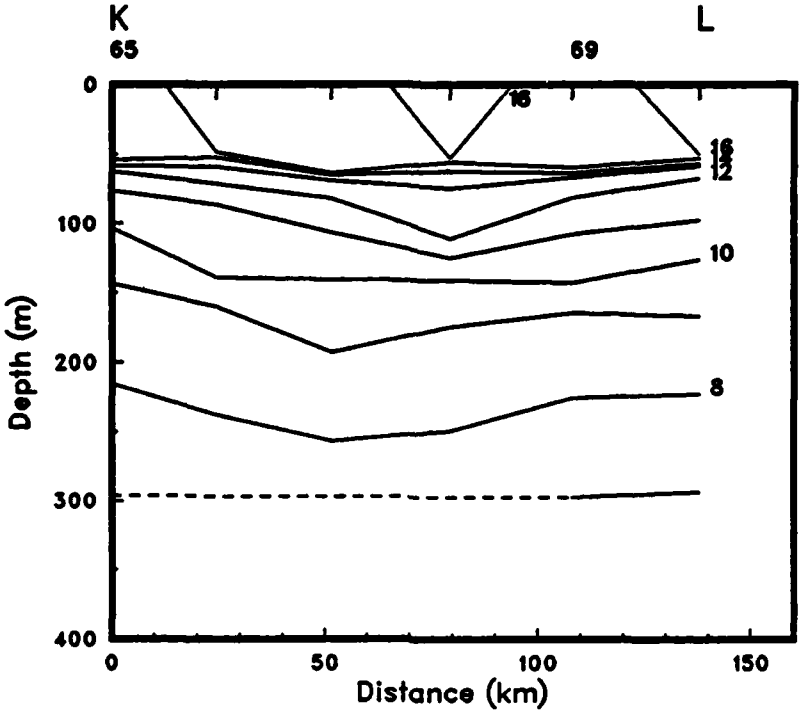
400
Depth (m)
16
14
12
10
8
0
50
100
150
Distance (km)

Figure 6 (e).


K
L
65
69
0
100
200
300
400
Depth (m)
16
16
12
10
8
0
50
100
150
Distance (km)

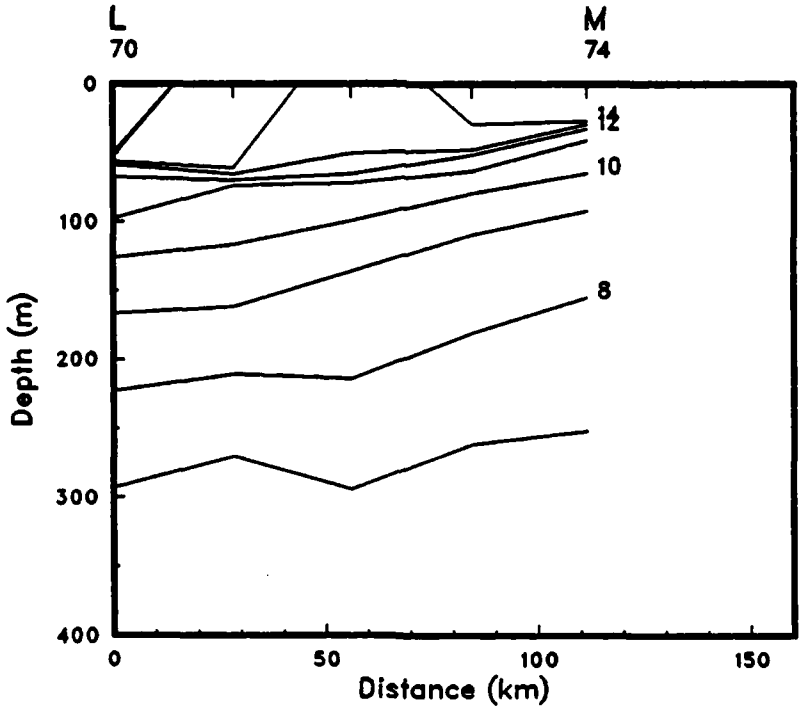

L
M
70
74
0
100
200
300
400
Depth (m)
12
10
8
0
50
100
150
Distance (km)

Figure 6 (f).

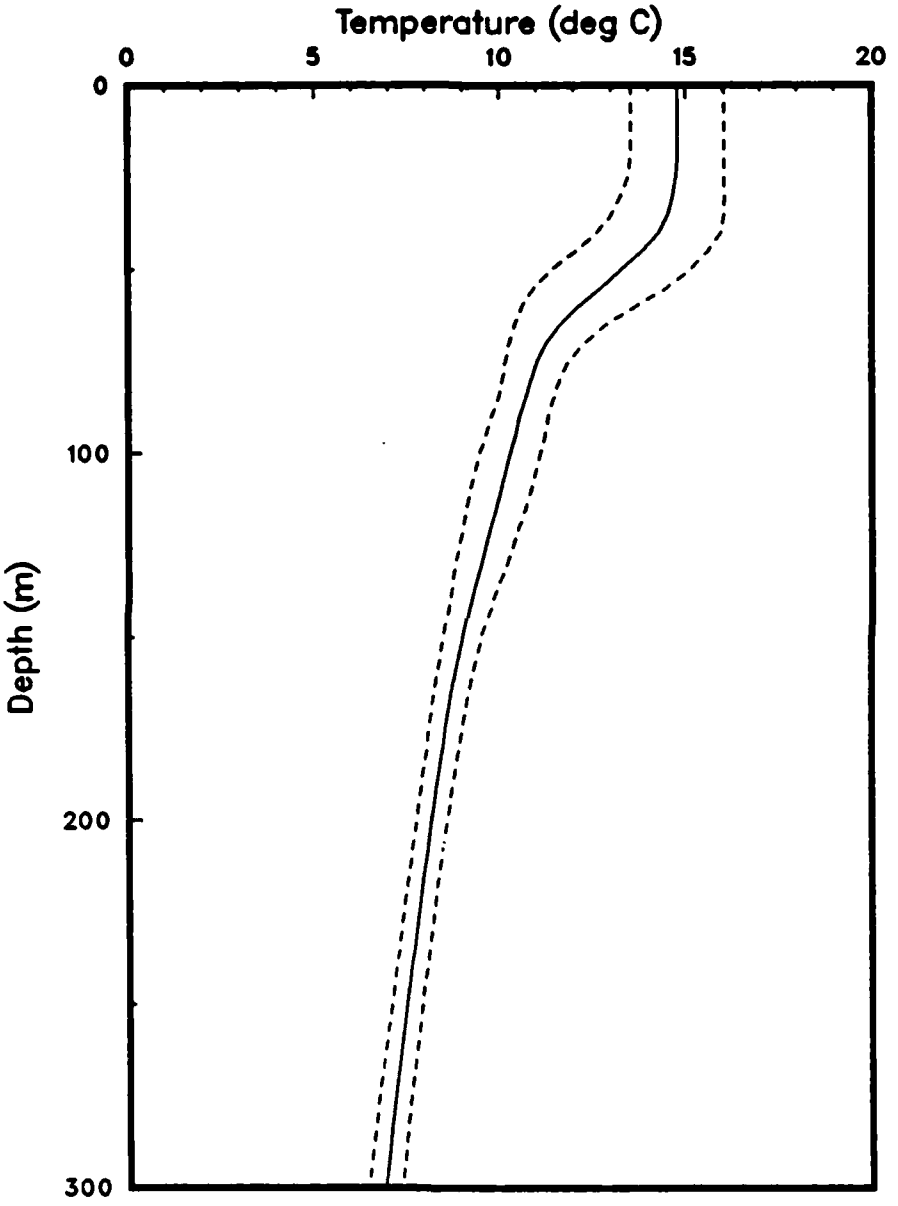


Figure 7. Mean temperature profile, with + and - the standard deviations, from OPTOMA18 Flight I.

SECTION 2

OPTOMA 18 FLIGHT II

NOVEMBER 2, 1985

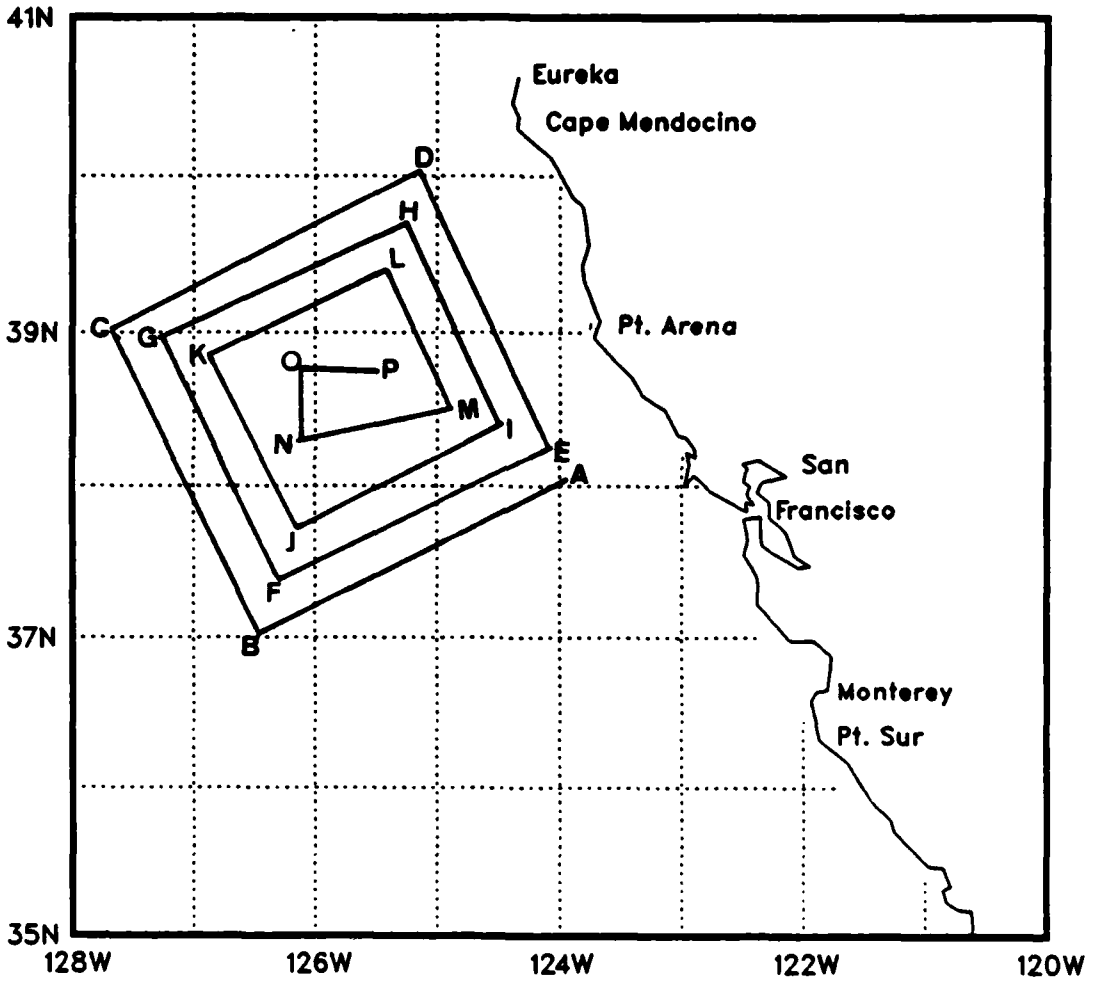


Figure 8. The flight track for OPTOMA18 Flight II.

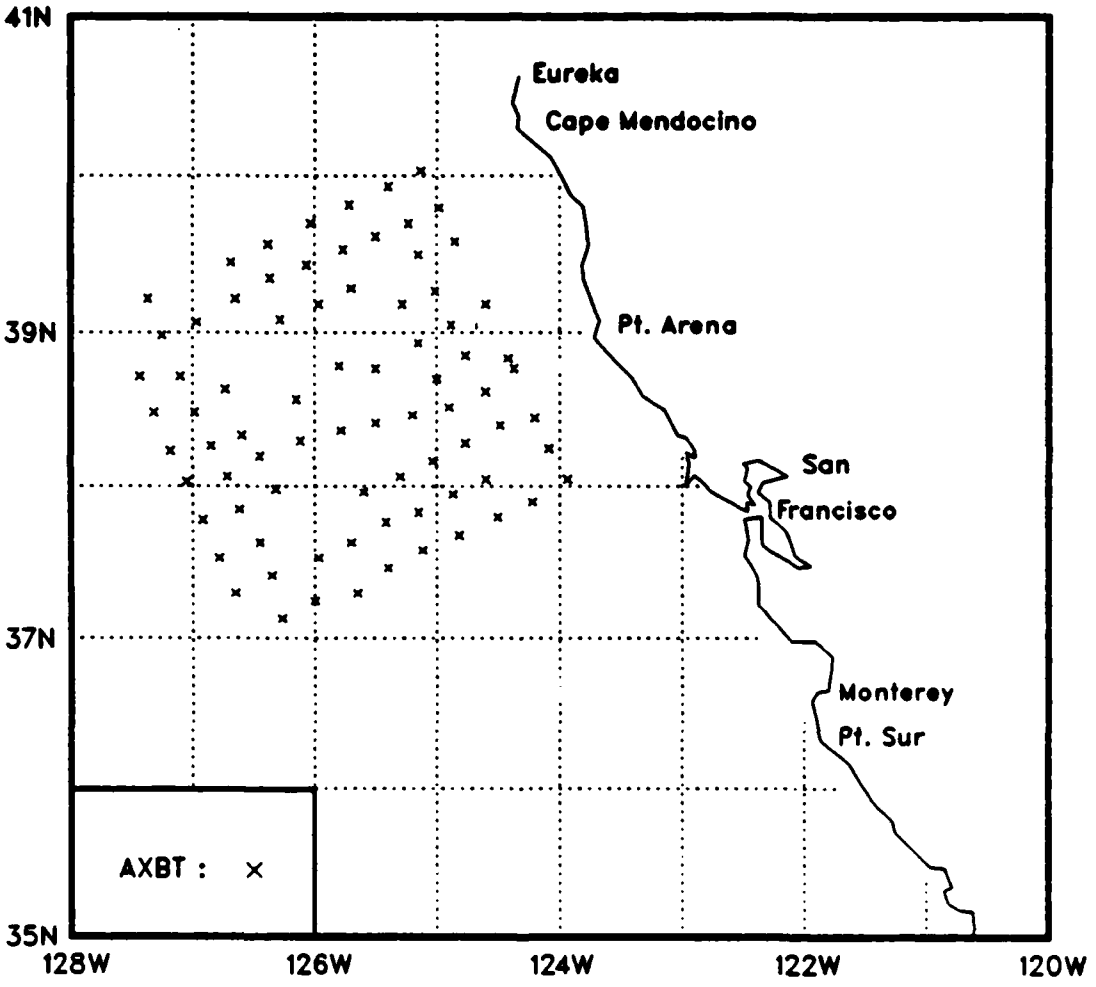


Figure 9. AXBT station locations for OPTOMA18 Flight II.

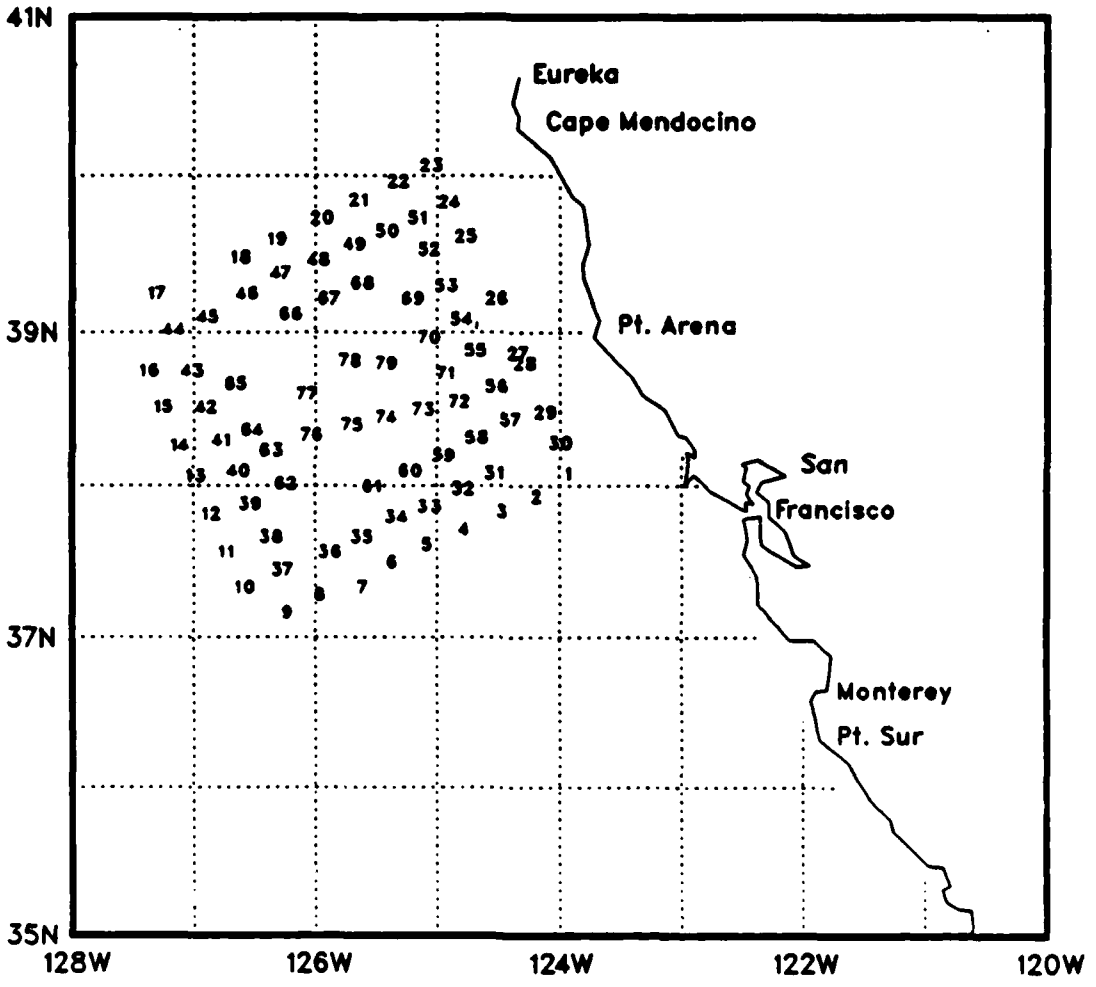


Figure 10. Station numbers for OPTOMA18 Flight II.

Table 2: Flight II Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
1	AXBT	85306	1812	38.03	123.56	12.8
2	AXBT	85306	1814	37.54	124.13	13.1
3	AXBT	85306	1821	37.48	124.30	13.0
4	AXBT	85306	1826	37.41	124.49	14.3
5	AXBT	85306	1830	37.35	125.07	13.8
6	AXBT	85306	1832	37.28	125.24	14.5
7	AXBT	85306	1839	37.18	125.39	14.3
8	AXBT	85306	1841	37.15	126.00	14.7
9	AXBT	85306	1848	37.08	126.16	15.3
10	AXBT	85306	1852	37.18	126.39	15.9
11	AXBT	85306	1901	37.32	126.47	15.8
12	AXBT	85306	1903	37.47	126.55	16.2
13	AXBT	85306	1912	38.02	127.03	15.9
14	AXBT	85306	1913	38.14	127.11	15.2
15	AXBT	85306	1922	38.29	127.19	14.8
16	AXBT	85306	1923	38.43	127.26	14.7
17	AXBT	85306	1939	39.13	127.22	16.2
18	AXBT	85306	1949	39.27	126.41	13.8
19	AXBT	85306	1956	39.34	126.23	13.4
20	AXBT	85306	1957	39.42	126.02	13.4
21	AXBT	85306	2005	39.49	125.43	13.6
22	AXBT	85306	2009	39.56	125.24	12.8
23	AXBT	85306	2014	40.02	125.08	11.8
24	AXBT	85306	2017	39.48	124.59	11.4
25	AXBT	85306	2021	39.35	124.51	12.9
26	AXBT	85306	2027	39.11	124.36	13.2
27	AXBT	85306	2033	38.50	124.25	13.4
28	AXBT	85306	2034	38.46	124.22	12.5
29	AXBT	85306	2041	38.27	124.12	13.3
30	AXBT	85306	2044	38.15	124.05	13.1
31	AXBT	85306	2050	38.03	124.36	13.9
32	AXBT	85306	2056	37.57	124.52	13.9
33	AXBT	85306	2057	37.50	125.09	14.2
34	AXBT	85306	2104	37.46	125.25	14.1
35	AXBT	85306	2106	37.38	125.42	14.5
36	AXBT	85306	2112	37.32	125.58	14.4
37	AXBT	85306	2118	37.25	126.21	15.0
38	AXBT	85306	2123	37.38	126.27	14.8
39	AXBT	85306	2127	37.51	126.37	14.9
40	AXBT	85306	2132	38.04	126.43	15.0
41	AXBT	85306	2134	38.16	126.51	15.2
42	AXBT	85306	2141	38.29	126.59	14.9
43	AXBT	85306	2145	38.43	127.06	15.0
44	AXBT	85306	2151	38.59	127.15	15.1
45	AXBT	85306	2154	39.04	126.58	15.9

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
46	AXBT	85306	2201	39.13	126.39	14.8
47	AXBT	85306	2205	39.21	126.22	13.2
48	AXBT	85306	2210	39.26	126.04	12.6
49	AXBT	85306	2211	39.32	125.46	13.5
50	AXBT	85306	2219	39.37	125.30	13.3
51	AXBT	85306	2223	39.42	125.14	11.7
52	AXBT	85306	2227	39.30	125.09	12.9
53	AXBT	85306	2229	39.16	125.01	13.2
54	AXBT	85306	2235	39.03	124.53	13.2
55	AXBT	85306	2237	38.51	124.46	13.7
56	AXBT	85306	2243	38.37	124.36	12.6
57	AXBT	85306	2245	38.24	124.29	13.4
58	AXBT	85306	2252	38.17	124.46	14.2
59	AXBT	85306	2256	38.10	125.02	14.9
60	AXBT	85306	2301	38.04	125.18	14.5
61	AXBT	85306	2303	37.58	125.36	14.7
62	AXBT	85306	2319	37.59	126.19	15.1
63	AXBT	85306	2324	38.12	126.27	15.3
64	AXBT	85306	2329	38.20	126.36	14.4
65	AXBT	85306	2334	38.38	126.44	14.7
66	AXBT	85306	2336	39.05	126.17	13.9
67	AXBT	85306	2349	39.11	125.58	12.9
68	AXBT	85306	2356	39.17	125.42	13.9
69	AXBT	85307	5	39.11	125.17	13.3
70	AXBT	85307	6	38.56	125.09	13.5
71	AXBT	85307	14	38.42	125.00	14.2
72	AXBT	85307	14	38.31	124.54	14.6
73	AXBT	85307	22	38.28	125.12	14.0
74	AXBT	85307	24	38.25	125.30	14.7
75	AXBT	85307	31	38.22	125.47	14.8
76	AXBT	85307	32	38.18	126.07	15.0
77	AXBT	85307	41	38.34	126.09	14.9
78	AXBT	85307	50	38.47	125.48	14.6
79	AXBT	85307	52	38.46	125.30	14.2

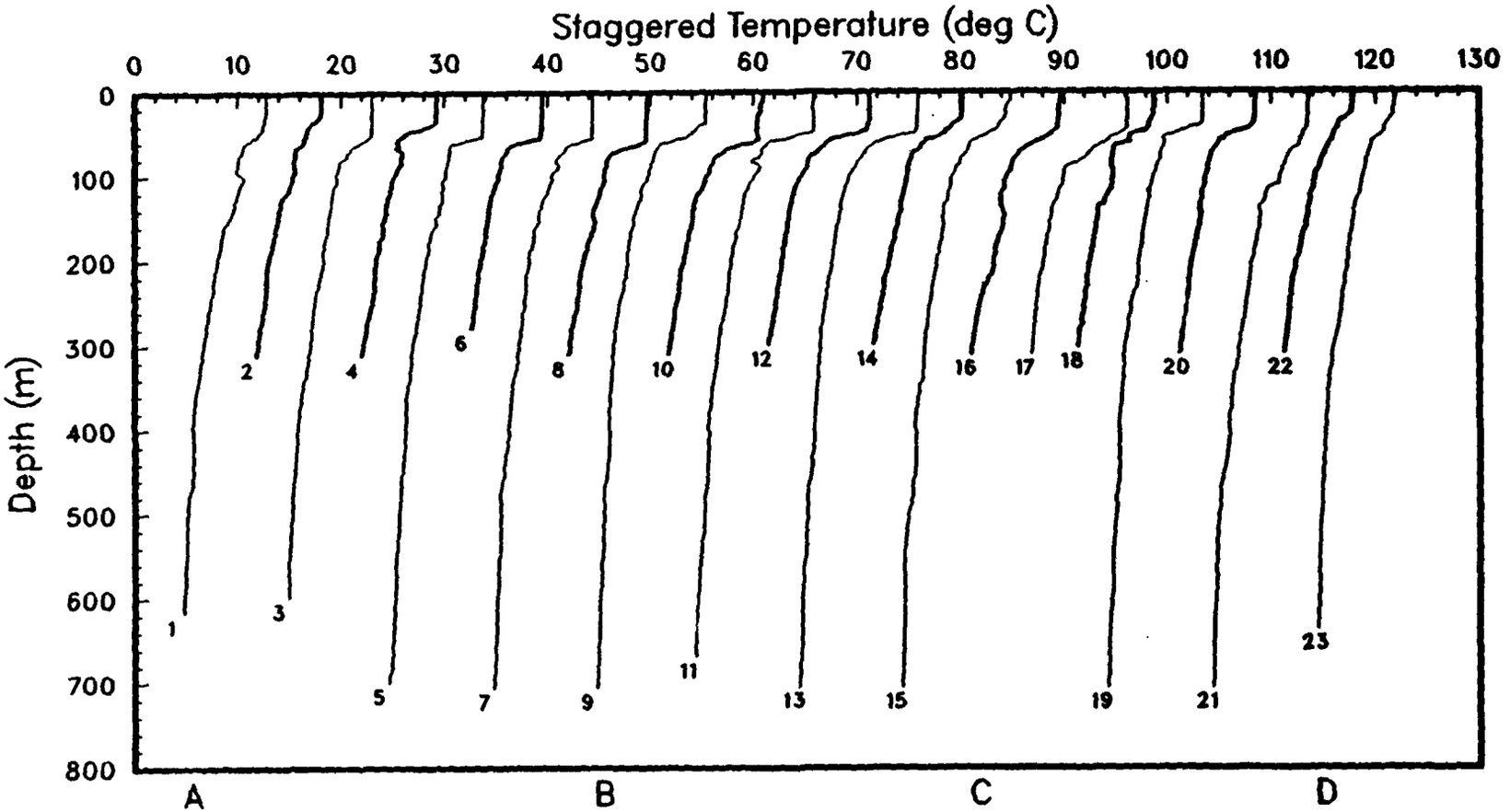


Figure 11 (a). Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight II).

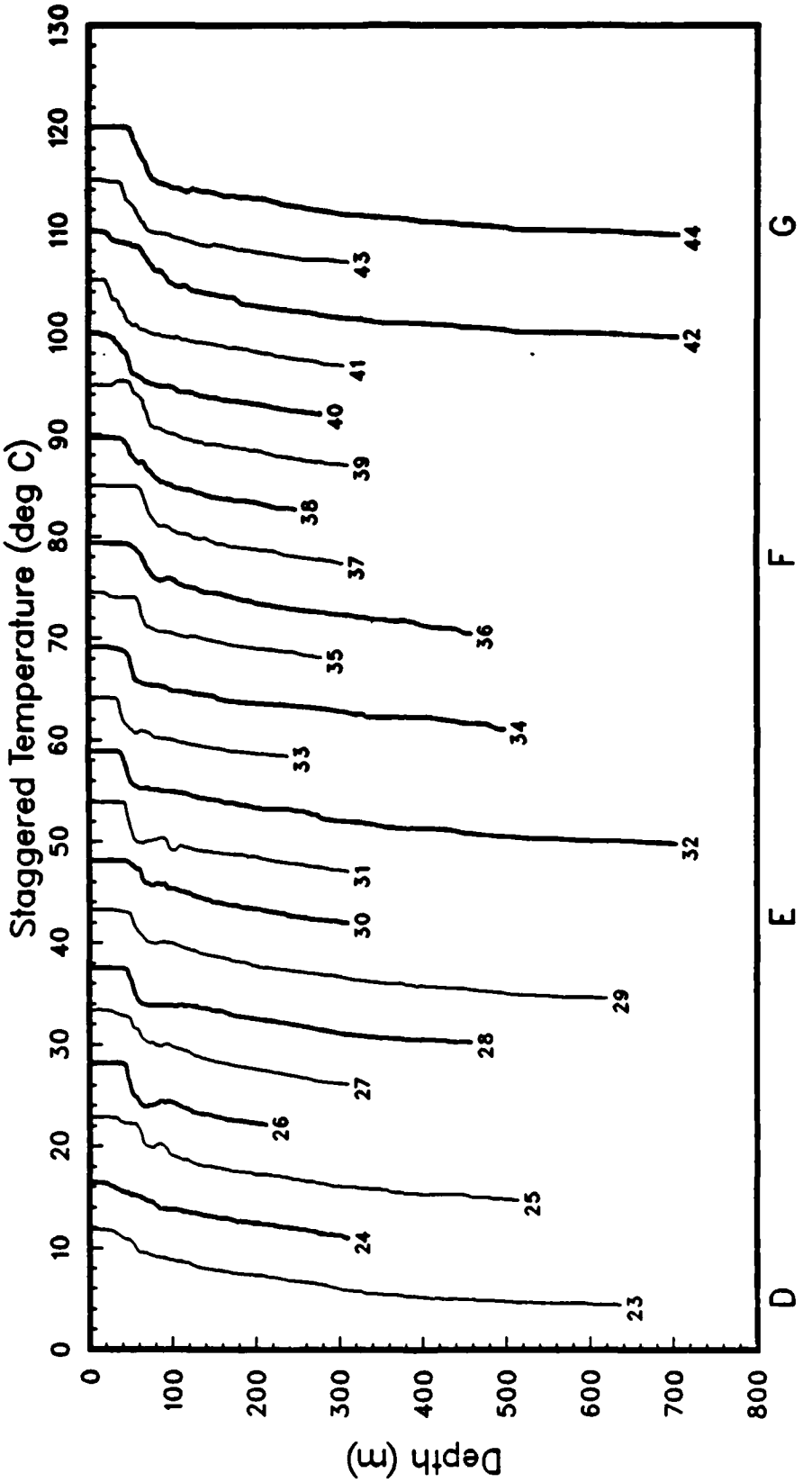

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Depth (m)
0
100
200
300
400
500
600
700
800
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
D
E
F
G

Figure 11 (b).

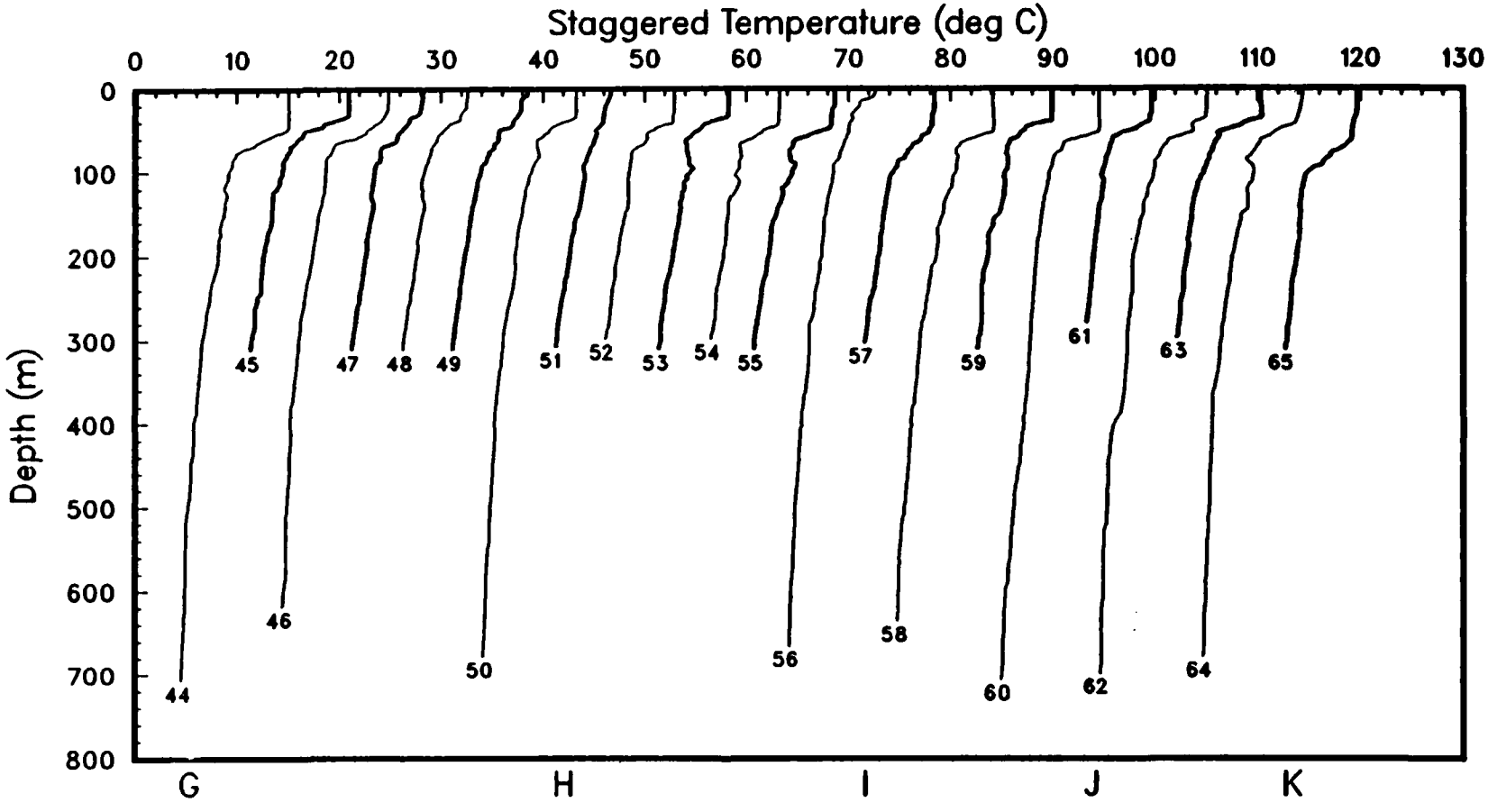

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Depth (m)
0
100
200
300
400
500
600
700
800
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
G
H
I
J
K

Figure 11 (c).

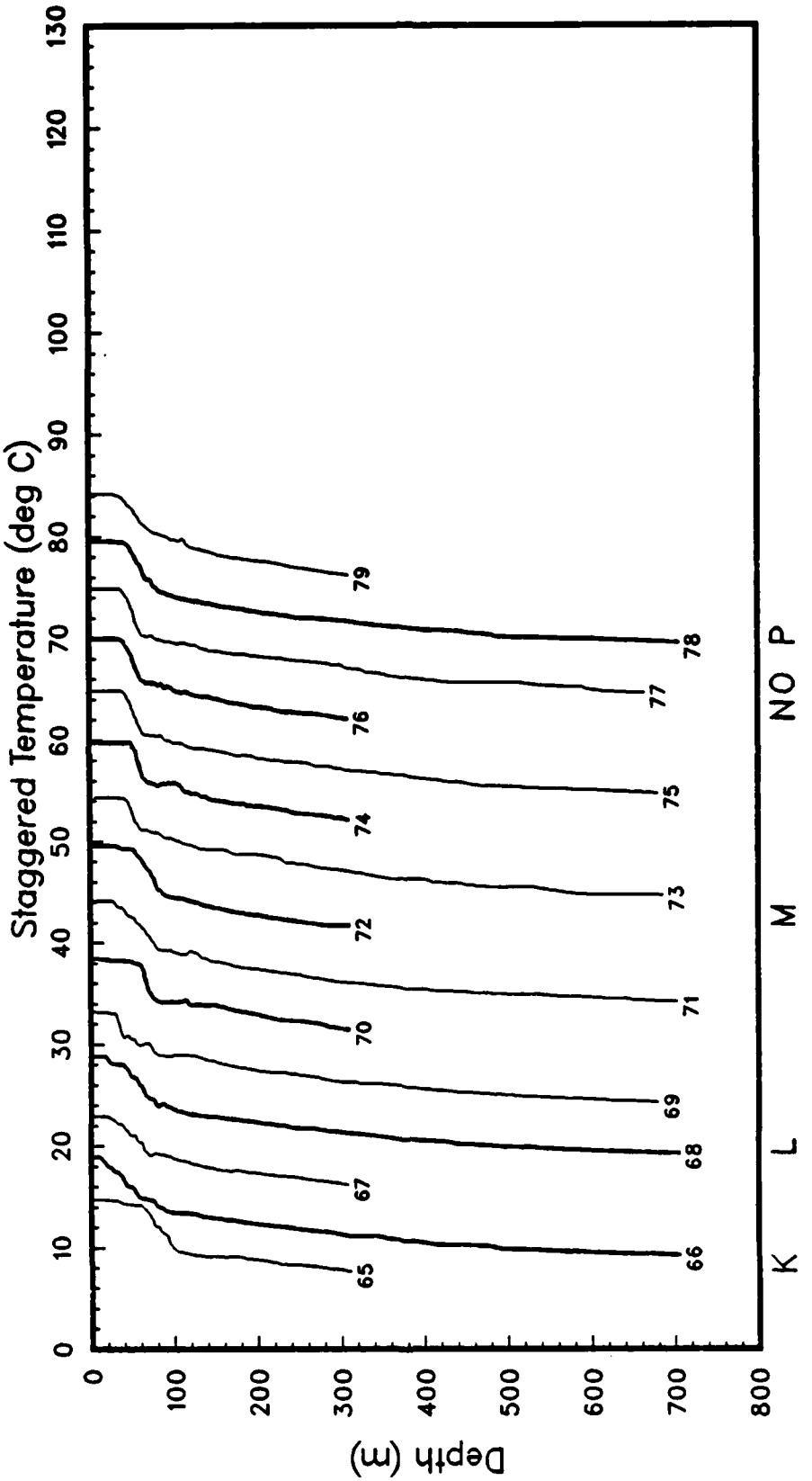
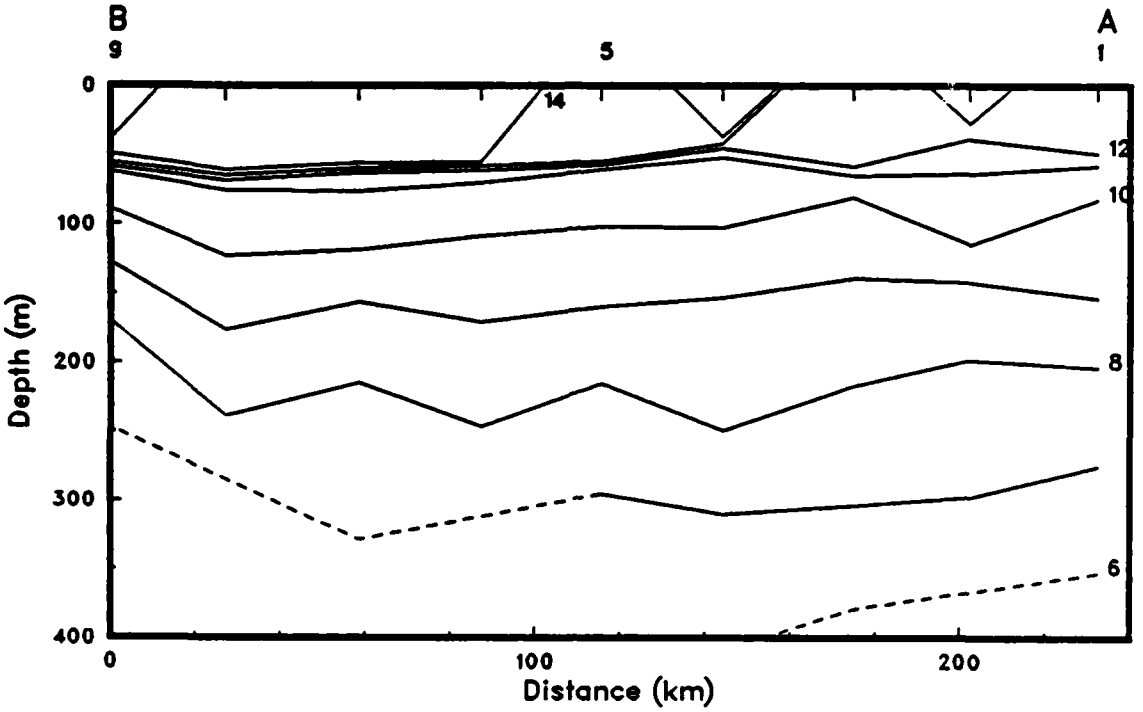

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Depth (m)
0
100
200
300
400
500
600
700
800
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
K
L
M
NO P

Figure 11 (d).



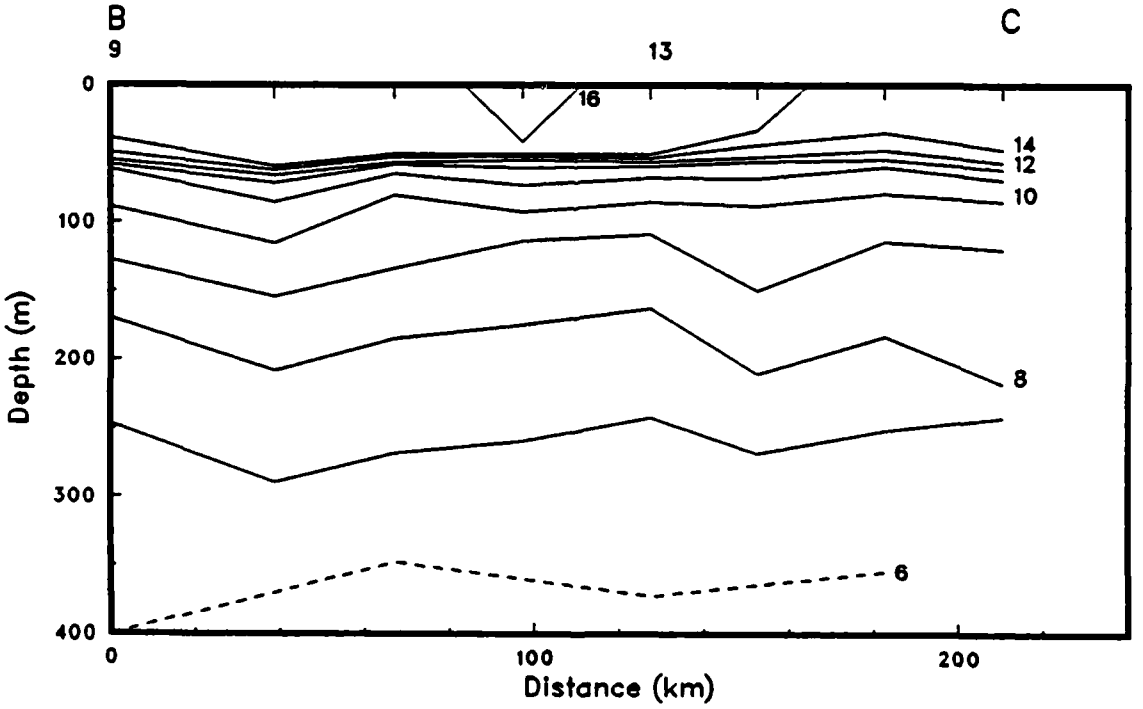
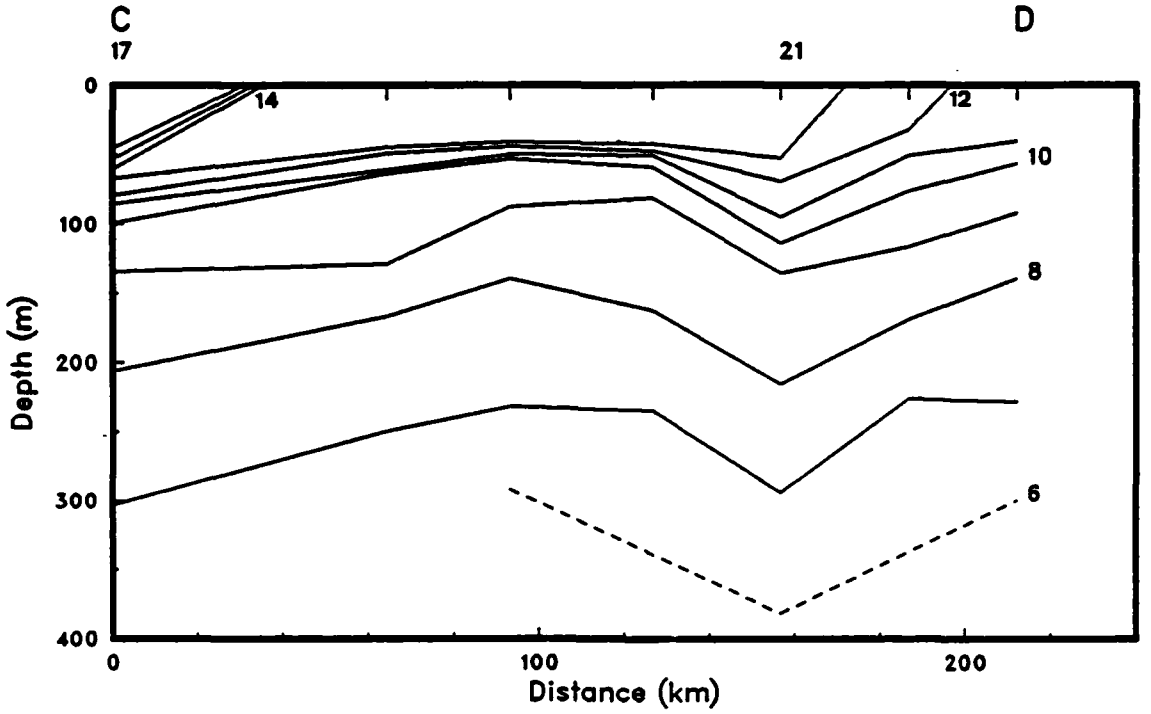


Figure 12 (a). Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA18 Flight II).


C
D
17
21
0
14
12
10
100
8
Depth (m)
200
300
6
400
0
100
200
Distance (km)

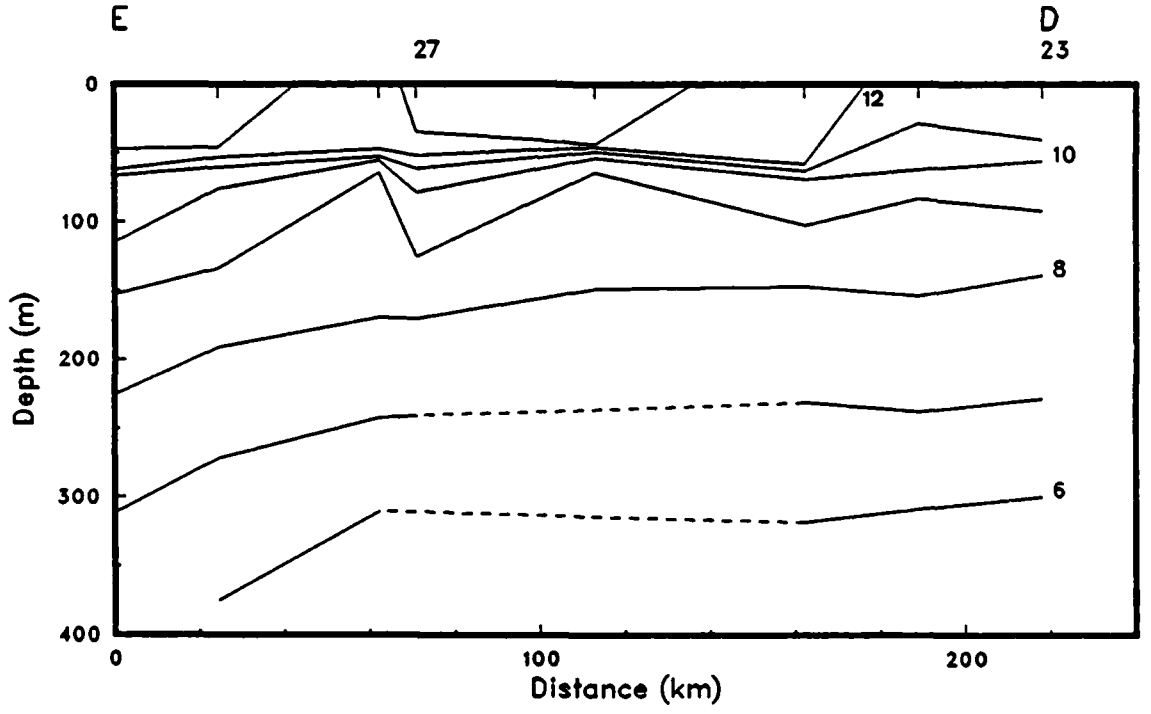
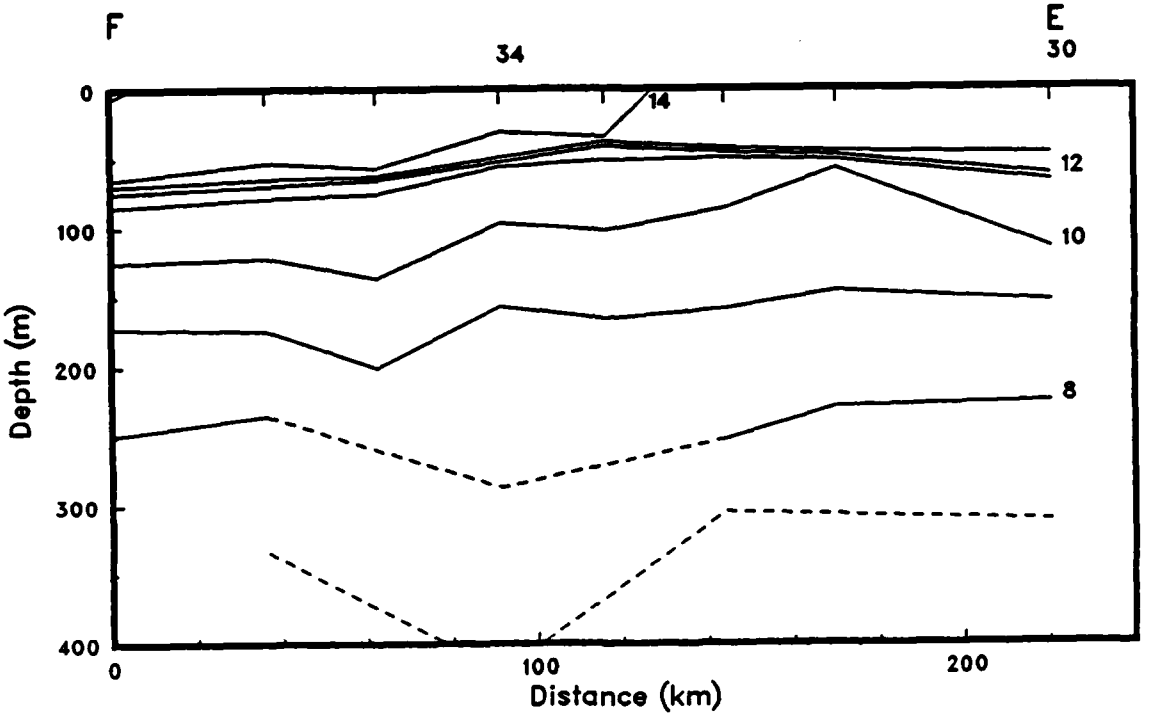

E
D
27
23
0
12
10
100
8
Depth (m)
200
300
6
400
0
100
200
Distance (km)

Figure 12 (b).


F
E
34
30
0
100
200
300
400
14
12
10
8
Depth (m)
0
100
200
Distance (km)

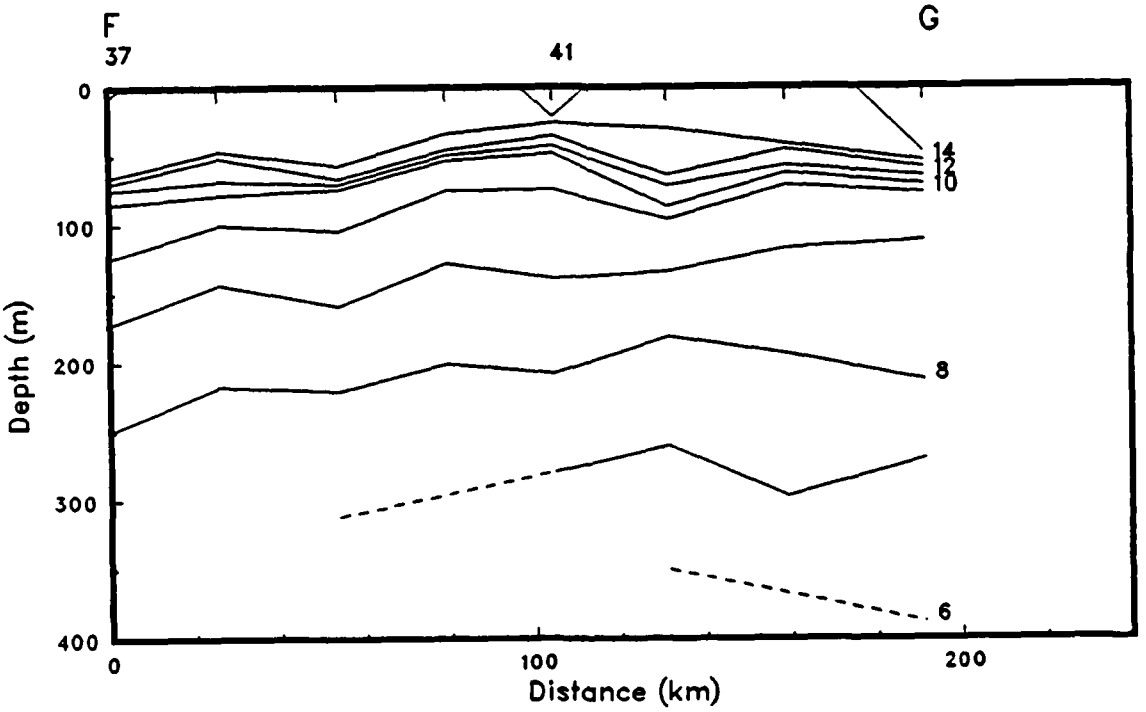
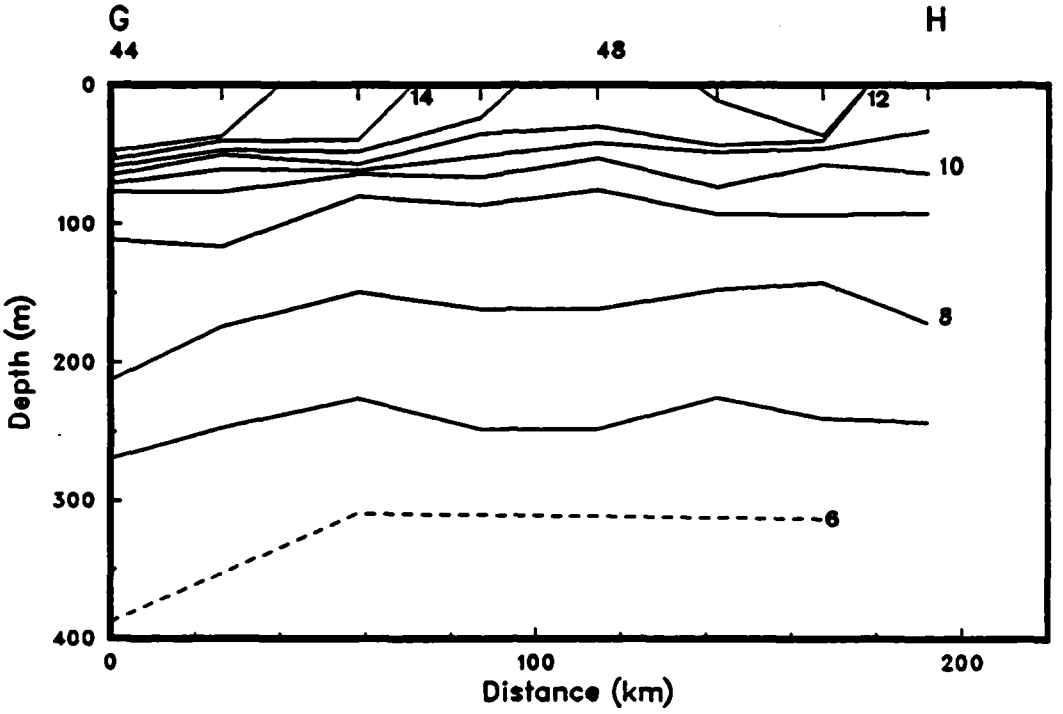

F
G
37
41
0
100
200
300
400
14
12
10
8
6
Depth (m)
0
100
200
Distance (km)

Figure 12 (c).


G
H
44
48
0
100
200
300
400
14
12
10
8
6
Depth (m)
0
100
200
Distance (km)

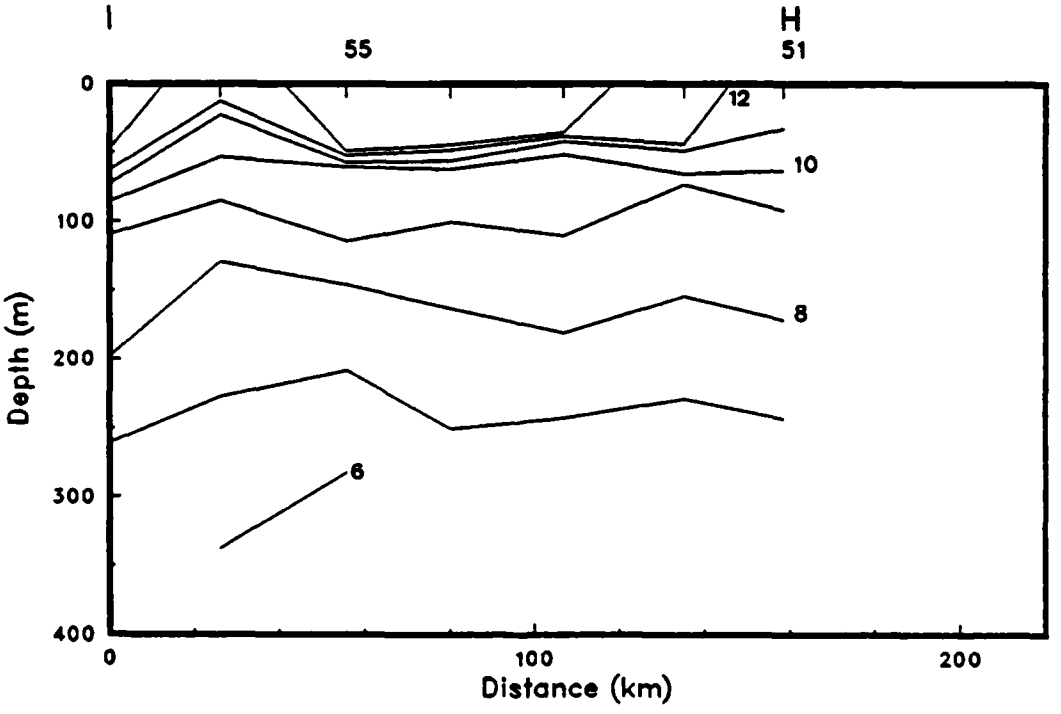
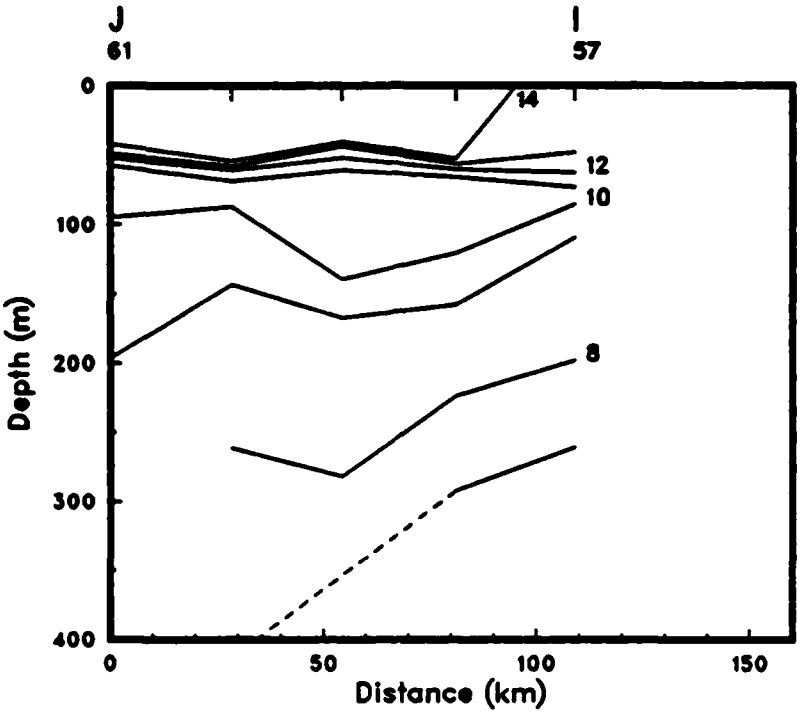

I
H
55
51
0
100
200
300
400
12
10
8
6
Depth (m)
0
100
200
Distance (km)

Figure 12 (d).


J
61
I
57
0
100
200
300
400
Depth (m)
14
12
10
8
0
50
100
150
Distance (km)

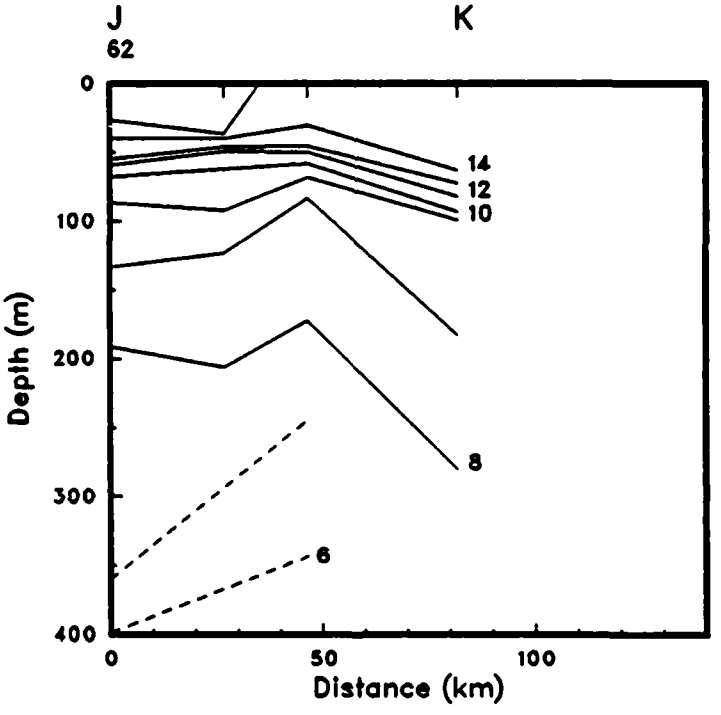
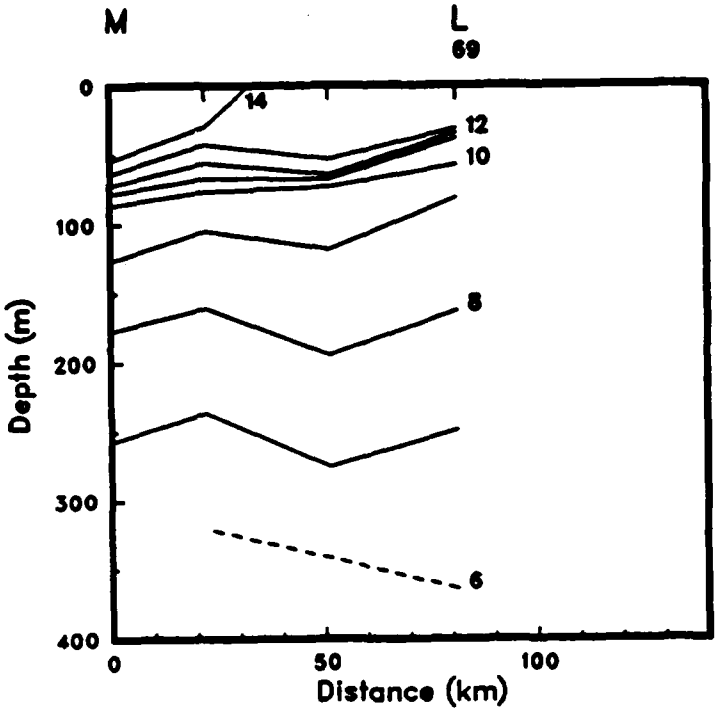

J
62
K
0
100
200
300
400
Depth (m)
14
12
10
8
6
0
50
100
Distance (km)

Figure 12 (e).


M
L
69
0
14
12
10
100
8
200
Depth (m)
300
6
400
0
50
100
Distance (km)

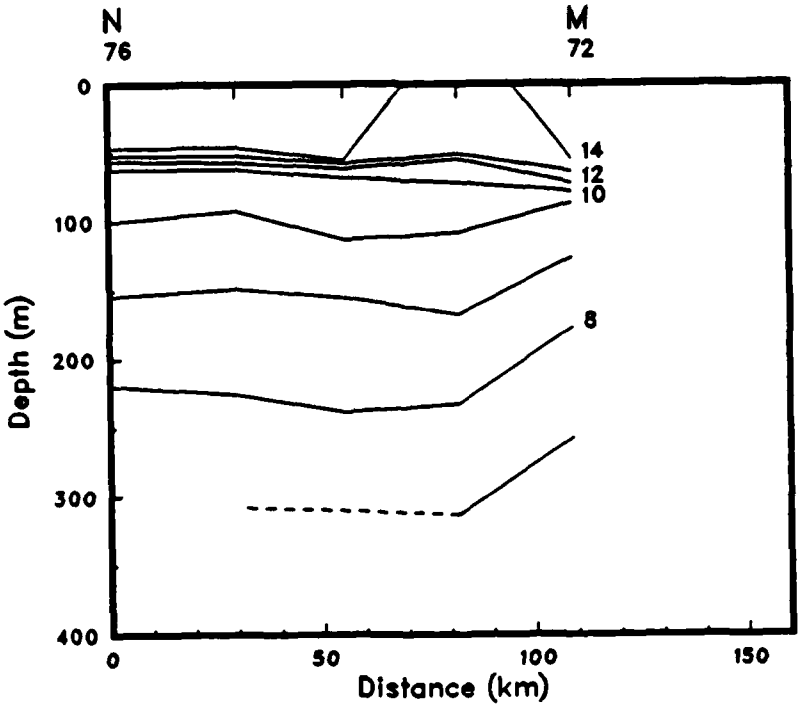

N
76
M
72
0
14
12
10
100
8
200
Depth (m)
300
400
0
50
100
150
Distance (km)

Figure 12 (f).

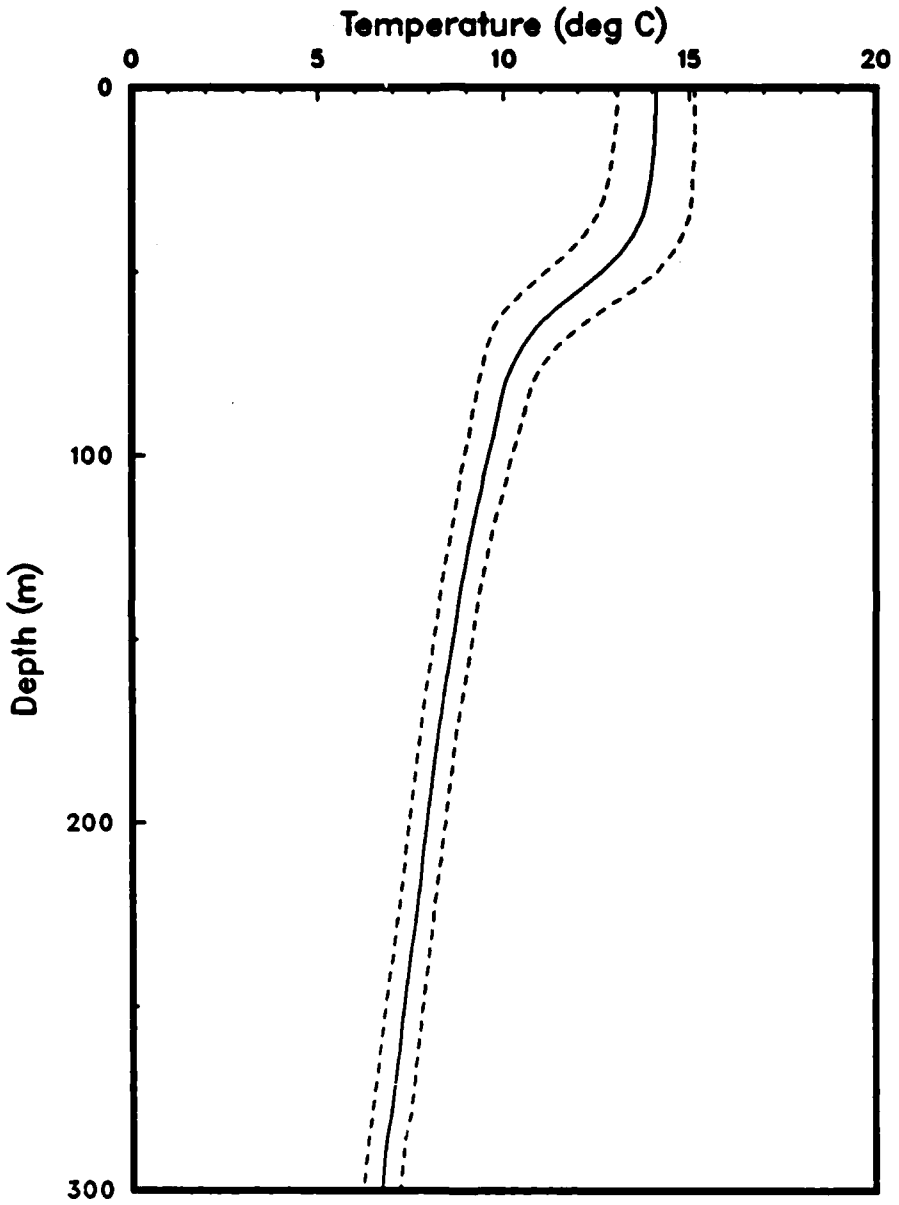


Figure 13. Mean temperature profile, with + and - the standard deviations, from OPTOMA18 Flight II.

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This research was sponsored by the ONR Physical Oceanography Program. The success of the fieldwork was strongly dependent on the competent, willing support of the Patrol Wing and Navy Reserve Patrol Wing. Members of the scientific crew were Ms. Marie Colton, NEPRF, and LT John J. Rendine, USN, NPS.

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30. Defense Technical Information Center — 2
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31. Dudley Knox Library — 2
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32. Research Administration (Code 012) — 1
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